



NORTHEAST AREA MONITORING AND ASSESSMENT PROGRAM

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Northeast Area Monitoring and Assessment Program (NEAMAP)

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Table of Contents

Introduction	1
Methods	2
Results	15
Literature Cited	80
Figures	
Survey Area	83
Sampling Sites	84
Bottom Temperatures	90
Water Column Temperatures	103
Gear Performance.....	104
Atlantic Sturgeon Catch History.....	106
Sea Turtle Catch History.....	107
Coastal Shark Catch History	108
Species Data Summaries (Figures and Tables)	
Alewife	110
American Goosefish	116
American Lobster	121
American Shad	126
Atlantic Cod.....	131
Atlantic Croaker	134
Atlantic Menhaden	143
Bay Anchovy.....	148
Black Drum	151
Black Sea Bass	157
Blueback Herring.....	166
Bluefish.....	171
Brown Shrimp	179
Butterfish	182
Clearnose Skate.....	189
Horseshoe Crab.....	195
Kingfish.....	201

Little Skate.....	206
Longfin Inshore Squid	212
Sandbar Shark	216
Scup.....	220
Silver Hake.....	228
Smooth Butterfly Ray.....	234
Smooth Dogfish.....	237
Spanish Mackerel	244
Spiny Butterfly Ray.....	248
Spiny Dogfish.....	251
Spot	258
Striped Anchovy	263
Striped Bass.....	266
Summer Flounder	272
Tautog	282
Weakfish	287
White Shrimp	296
Windowpane Flounder	299
Winter Flounder	304
Winter Skate	314
Yellowtail Flounder	320

Introduction

Concerns regarding the status of fishery-independent data collection from continental shelf waters between Cape Hatteras, North Carolina and the U.S. / Canadian border led the Atlantic States Marine Fisheries Commission's (ASMFC) Management and Science Committee (MSC) to draft a resolution in 1997 calling for the formation of the Northeast Area Monitoring and Assessment Program (NEAMAP) (ASMFC 2002). NEAMAP is a cooperative state-federal program modeled after the Southeast Area Monitoring and Assessment Program (SEAMAP), which has been coordinating fishery-independent data collection south of Cape Hatteras since the mid-1980s (Rester 2001). The four main goals of this new program directly address the deficiencies noted by the MSC for this region and include 1) developing fishery-independent surveys for areas where current sampling is either inadequate or absent 2) coordinating data collection among existing surveys as well as any new surveys 3) providing for efficient management and dissemination of data and 4) establishing outreach programs (ASMFC 2002). The NEAMAP Memorandum of Understanding was signed by all partner agencies by July 2004.

One of the first major efforts of the NEAMAP was to design a trawl survey that would operate in the coastal zone (i.e., between the 6.1 m and 27.4 m depth contours) of the Mid-Atlantic Bight (MAB - i.e., Montauk, New York to Cape Hatteras, North Carolina). While the National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center's (NEFSC) Bottom Trawl Survey had been sampling from Cape Hatteras to the U.S. / Canadian border in waters less than 366 m since 1963, few sites were sampled inshore of the 27.4 m contour due to the sizes of the sampling area and research vessels (NEFSC 1988, R. Brown, NMFS, pers. comm). In addition, of the six coastal states in the MAB, only New Jersey conducts a fishery-independent trawl survey in its coastal zone (Byrne 2004). The NEAMAP Southern New England and Mid Atlantic Near Shore Trawl Survey (NEAMAP SNE/MA) was therefore developed to address this gap in fishery-independent survey coverage, which is consistent with the program goals. The main objectives of this new survey were defined to include the estimation of abundance, biomass, length frequency distribution, age-structure, diet composition, and various other assessment-related parameters for fishes and select invertebrates inhabiting the survey area.

In early 2005, the ASMFC received \$250,000 through the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) and made these funds available for pilot work designed to assess the viability of the NEAMAP SNE/MA. The Virginia Institute of Marine Science (VIMS) provided the sole response to the Commission's request for proposals and was awarded the contract for this work in August 2005. VIMS conducted two brief pre-pilot cruises and a full pilot survey in 2006 (Bonzek *et al.* 2007).

Following a favorable review of the pilot sampling, the ASMFC bundled funds from a combination of sources in an effort to provide the resources necessary to support the initiation of full-scale sampling operations for NEAMAP SNE/MA. The ASMFC awarded VIMS this new contract in the late spring of 2007, and the first full NEAMAP SNE/MA cruise was scheduled for fall 2007.

Two significant changes to the NEAMAP SNE/MA survey area were implemented prior to this first full-scale cruise:

- In 2007, the NEFSC took delivery of the *FSV Henry B. Bigelow*, began preliminary sampling operations with this new vessel, and determined that this boat could safely operate in waters as shallow as 18.3 m. NEFSC personnel then determined that future surveys would likely extend inshore to that depth contour (R. Brown, NMFS, pers. comm.). The NEAMAP Operations Committee subsequently decided that the offshore boundary of the NEAMAP SNE/MA survey between Montauk and Cape Hatteras should be realigned to coincide with the inshore boundary of the NEFSC survey, and that NEAMAP SNE/MA should discontinue sampling between the 18.3 m and 27.4 m contours in these waters.
- The NEFSC contributed an appreciable amount of funding toward NEAMAP SNE/MA full implementation with the provision that Block Island Sound (BIS) and Rhode Island Sound (RIS), regions that were under-sampled at the time, be added to the NEAMAP SNE/MA sampling area. These waters are deeper than those sampled along the coast by NEAMAP SNE/MA; however, the offshore extent of sampling in these sounds (with respect to distance from shore) is consistent with that along the coast. The NEAMAP SNE/MA Survey has sampled BIS and RIS since the fall of 2007 and intends to continue to do so.

VIMS acquired funding for full sampling (i.e., two cruises, one in the spring and one in the fall, each covering the entire survey range) in 2008 from two sources, ASMFC “Plus-up” funds and Research Set-Aside (RSA) quota provided by the Mid-Atlantic Fishery Management Council and the National Oceanographic and Atmospheric Administration (NOAA). ASMFC “Plus-up” was used for the spring survey, while the proceeds derived from the auction of RSA quota supported the fall cruise. All sampling in 2009 and 2010 was funded through the Mid-Atlantic RSA Program; for 2011 and 2012, partial support (approximately 20%) was gained through the Commercial Fisheries Research Foundation (CFRF) for operations in BIS and RIS. This report summarizes the results of the both the spring and fall 2013 survey cruises and for many analyses includes data for all prior cruises.

Methods

The following protocols and procedures were developed by the ASMFC NEAMAP Operations Committee, Trawl Technical Committee, and survey personnel at VIMS and approved through an external peer review of the NEAMAP SNE/MA Trawl Survey. This review was conducted in December 2008 in Virginia Beach, Virginia, and all associated documents are currently available (Bonzek *et al.* 2008, ASMFC 2009). While the review found no major deficiencies with the survey, some recommendations were offered to improve data collection both in the field and in the laboratory. Efforts to implement these suggestions are ongoing and are discussed in the following sections where they occur.

Stratification of the Survey Area / Station Selection

Sampling sites are selected for each cruise of the NEAMAP SNE/MA Near Shore Trawl Survey using a stratified random design. During the planning stages of the survey, the Operations Committee and personnel at VIMS developed a stratification scheme for the survey area. Because the NEFSC sampled these same waters for decades prior to the arrival of the *Bigelow*, and since the NEAMAP SNE/MA Survey is effectively viewed as an inshore complement to the NEFSC Bottom Trawl Surveys, consistency with the historical strata boundaries used by the NEFSC for the inshore waters of the MAB and Southern New England (SNE) was the primary consideration. Alternate stratification options for the near shore coastal zone (i.e., NEAMAP SNE/MA sampling area) were also open for consideration.

An examination of NEFSC inshore strata revealed that the major divisions among survey regions (latitudinal divisions from New Jersey to the south, longitudinal divisions off of Long Island and in BIS and RIS) generally correspond well with major estuarine outflows (Figure 1). These boundary definitions were therefore adopted for use by the NEAMAP SNE/MA Survey; minor modifications were made to align regional boundaries more closely with state borders. Evaluation of the NEFSC depth strata definitions, however, indicated that in some areas (primarily in the more southern regions) near shore stratum boundaries did not correspond well to actual depth contours. NEAMAP SNE/MA depth strata were therefore redrawn using depth sounding data from the National Ocean Service and strata ranges of 6.1 m - 12.2 m and 12.2 m - 18.3 m from Montauk to Cape Hatteras, and 18.3 m - 27.4 m and 27.4 m - 36.6 m in BIS and RIS. Following the delineation of strata, each region / depth stratum combination was subdivided into a grid pattern, with each cell of the grid measuring 1.5 x 1.5 minutes (1.8 nm², corrected for the difference in nm per degree of longitude at the latitudes sampled by the survey) and representing a potential sampling site. In 2013 these grid cells were reexamined, as the rectangular shape of each cell necessarily meant that some cells extended into waters beyond the depth boundaries of the survey and even onto land. Prior to this review the 'untrawlable' portions of such cells were estimated by eye and the cell weight was adjusted proportionally. During this assessment the boundaries of such cells were redrawn to closely correspond with the contours within the defined depth range of the survey. These new cell definitions were input into a Geographic Information System so that the area of each cell could be accurately calculated and the appropriate cell weight defined.

One of the main goals of the NEAMAP SNE/MA trawl survey is to increase fishery-independent sampling intensity in the nearshore zone of the MAB and SNE. When designing the survey, it was decided that the target sampling intensity would be approximately 1 station per 30 nm², a moderately high intensity when compared with other fishery-independent trawl surveys operating along the US East Coast. This intensity, when applied to the NEAMAP SNE/MA survey area, results in the sampling of 150 sites per cruise. The number of cells (sites) to be sampled in each stratum during each survey cruise was then determined by proportional allocation, based on the surface area of each stratum (Table 1 – note that the values in this table differ slightly from those in the same table in prior reports due to the cell boundary redefinition described above). A minimum of 2 sites was assigned to smallest of the strata (i.e., those receiving less than 2 based on proportional allocation).

Prior to each survey, a SAS program is used to randomly select the cells to be sampled from each region / depth stratum during that cruise (SAS, 2002). Again, the number of cells selected in a particular stratum is approximately proportional to the surface area of that stratum. Once these 150 ‘primary’ sampling sites (i.e., those to be sampled during the upcoming cruise) are generated, the program selects a set of ‘alternate’ sites. In instances where sampling a primary site is not possible due to fixed gear, bad bottom, vessel traffic, etc., an alternate site is selected in its stead. If an alternate is sampled in the place of an untowable primary, the alternate is required to occupy the same region / depth stratum as the aberrant primary. Usually, the alternate chosen is the closest towable alternate to that primary. The actual locations sampled during both 2013 cruises are provided (Figure 2. A: spring survey, B: fall survey).

Table 1. Number of available sampling sites (Num. cells) in each region / depth stratum along with the number selected for sampling per stratum per cruise (Stations sampled). Totals for each region, along with surface area (nm²) and sampling intensity (nm² per Station) are also given.

Region	State*	Stations Sampled								Totals			nm ² per Station
		6.1m-12.2m		12.2m – 18.3m		18.3m – 27.4m		27.4m –36.6m		Stations sampled	Num. cells	nm ² **	
		Stations sampled	Num. cells										
RIS	RI					6	98	10	161	16	259	543.5	34.0
BIS	RI					3	49	7	89	10	138	288.0	28.8
1	NY	0	0	2	20					2	20	29.1	14.6
2	NY	2	18	3	20					5	38	37.3	7.5
3	NY	2	30	3	35					5	65	63.0	12.6
4	NY	2	28	3	35					5	63	100.1	20.0
5	NY	2	30	3	45					5	75	157.2	31.4
6	NJ	2	27	3	42					5	69	132.0	26.4
7	NJ	4	45	6	97					10	142	301.8	30.2
8	NJ	2	32	7	90					9	122	263.6	29.3
9	DE	4	59	8	113	5	69			17	241	527.5	31.0
10	MD	2	40	8	114					10	154	326.6	32.7
11	VA	5	63	8	122					13	185	389.6	30.0
12	VA	5	48	4	67					9	115	242.7	27.0
13	VA	6	92	10	142					16	234	502.1	31.4
14	NC	2	26	5	82					7	108	214.6	30.7
15	NC	2	31	4	70					6	101	197.1	32.9
Total		42	569	77	1094	14	216	17	259	150	2129	4315.8	28.8
<p>* Note that region boundaries are not perfectly aligned with all state boundaries:</p> <ul style="list-style-type: none"> • Some stations in RI Sound may occur in MA • Some stations in BI Sound may occur in NY • Region 5 spans the NY-NJ Harbor area • Some stations in Region 9 may occur in NJ <p>** Calculation does not account for decreases in distance per minute of longitude as latitude increases.</p>													

Species Priority Lists

During the survey design phase, the NEAMAP Operations Committee developed a set of species priority lists intended to guide catch processing and sample collection. Species of management interest in the MAB and SNE were to be of top priority and taken for full processing (see *Procedures at Each Station* below) at each sampling site in which they were collected (Table 2). Initially, this list was subdivided into Priority ‘A’, ‘B’, and ‘C’ so that if time and/or resources became limited, species could be eliminated from full processing in a manner that would preserve the most important species (i.e., Priority ‘A’) at the expense of those of lesser interest (‘B’ and ‘C’ species). In practice, because survey personnel work quickly and efficiently, time constraints are not an issue and it has never been necessary to eliminate any of the Priority ‘B’ or ‘C’ species from full processing. Because the species on each of these lists have been and will continue to be treated as though they are all ‘A’ species, the ‘B’ and ‘C’ designations were eliminated and all of these species were included as ‘A’ list. For all other fishes (here called Priority ‘D’), aggregate weights and individual length measurements, at a minimum, are recorded. A third category (‘E’) includes species which require special handling, such as sharks (other than dogfish) and sturgeon, which are measured, weighed, tagged, and released. Select invertebrates of management interest are also Priority ‘E’ species; individual length, weight, and sex are recorded, at a minimum, from these. One species, windowpane, was added to the ‘A’ list beginning in 2012. For presentation in this report a Priority ‘F’ category is also defined, which is constituted by species (invertebrates) which cannot be reasonably enumerated, weighed, and measured as other species (e.g. barnacles, sponges, various small shrimp species, squid ‘egg mops’) which may be accounted for by total number, total weight, or even just presence.

Table 2. Species priority ‘A’ list.

A LIST			
Alewife	<i>Alosa pseudoharengus</i>	Red drum	<i>Sciaenops ocellatus</i>
All skate species	<i>Leucoraja sp. & Raja sp.</i>	Scup	<i>Stenotomus chrysops</i>
American Shad	<i>Alosa sapidissima</i>	Silver Hake	<i>Merluccius bilinearis</i>
Atlantic Cod	<i>Gadus morhua</i>	Smooth Dogfish	<i>Mustelus canis</i>
Atlantic Croaker	<i>Micropogonias undulatus</i>	Spanish mackerel	<i>Scomberomorus maculatus</i>
Atlantic herring	<i>Clupea harengus</i>	Speckled trout	<i>Cynoscion nebulosus</i>
Atlantic mackerel	<i>Scomber scombrus</i>	Spiny Dogfish	<i>Squalus acanthias</i>
Atlantic Menhaden	<i>Brevoortia tyrannus</i>	Spot	<i>Leiostomus xanthurus</i>
Black Drum	<i>Pogonias cromis</i>	Striped Bass	<i>Morone saxatilis</i>
Black Sea Bass	<i>Centropristis striata</i>	Summer Flounder	<i>Paralichthys dentatus</i>
Blueback Herring	<i>Alosa aestivalis</i>	Tautog	<i>Tautoga onitis</i>
Bluefish	<i>Pomatomus saltatrix</i>	Weakfish	<i>Cynoscion regalis</i>
Butterfish	<i>Peprilus triacanthus</i>	Windowpane	<i>Scophthalmus aquosus</i>
Haddock	<i>Melanogrammus aeglefinus</i>	Winter flounder	<i>Pseudopleuronectes americanus</i>
Monkfish	<i>Lophius americanus</i>	Yellowtail flounder	<i>Limanda ferruginea</i>
Pollock	<i>Pollachius virens</i>		

Gear Performance

The NEAMAP SNE/MA Survey uses the 400 x 12cm, three-bridle four-seam bottom trawl designed by the Mid-Atlantic / New England Fishery Management Council Trawl Survey Advisory Panel for all sampling operations. This net is paired with a set of Thyboron, Type IV 66" doors. Wingspread, doorspread, and headrope height were monitored during each tow of the spring and fall 2013 cruises using a digital Netmind[®] Trawl Monitoring System. Bottom contact of the footgear was also evaluated using the Netmind system. Wingspread sensors were positioned on the middle 'jib' of the net, which is consistent with NEFSC procedures for this gear, and doorspread sensors were mounted in the trawl doors according to manufacturer specifications. The headrope sensor was affixed to the center of the headline. The bottom contact sensor, which is effectively an inclinometer, was attached to the center of the footrope and used to evaluate the timing of the initial bottom contact of the footgear at the beginning of a tow, liftoff of the footgear during haulback, and the behavior of the gear throughout each tow. The inclusion of this bottom contact sensor was based on the recommendations of the NEAMAP SNE/MA peer review panel. The bottom contact sensor was attached for all tows during the fall of 2009 and the resulting data confirmed that the net was on the bottom at the proper phases of each tow. Due to the relative complexity in attaching and detaching this sensor before and after each tow, in 2013 the sensor was used for only one tow per stratum per cruise. A catch sensor was mounted in the cod-end, and set to signal when the catch reached approximately 2,200 kg. GPS coordinates and vessel speed were recorded every 2 seconds during each tow. These data were used to plot tow tracks for each station.

It is important to note that, while the performance of the survey gear had been recorded on all previous cruises, NEAMAP SNE/MA began to use these data to assess tow validity in 2009. The peer review panel recommended that acceptable ranges be defined for headrope height and wingspread such that if the average value of either or both of these parameters for a given tow fell outside of these ranges, the tow be considered invalid, the catch discarded, and a re-tow of the sampling site be initiated. Doorspread was not included since doorspread and wingspread are typically highly correlated (Gómez and Jiménez 1994). Such a procedure is intended to promote consistency in the performance of the survey gear and resulting catch data. The review panel and VIMS personnel agreed that 4.7 m to 5.8 m would be an appropriate range for headrope height while 12.3 m to 14.7 m would be acceptable for wingspread. These values were generated by adding to the optimal ranges of each parameter (defined by the Trawl Survey Advisory Panel), 5% of the midpoint of each range. This use of trawl performance to assess tow validity was used successfully during both the spring and fall 2013 survey cruises, and it was not necessary to discard any tows due to poor gear performance.

Procedures at Each Sampling Site

The *F/V Darana R* served as the sampling platform for all field operations in 2013 as well as for all previous surveys (both pilot and full-scale cruises). This vessel is a 27.4 m (waterline length) commercial stern-dragger, owned and operated by Captain James A. Ruhle, Sr. of Wanchese, North Carolina.

All fishing operations were conducted during daylight hours. Standard tows were 20 minutes in duration with a target tow speed of 3.0 kts. During the spring 2013 cruise, no tows were truncated at less than the full 20 minutes. A single tow was shortened to 15 minutes during the fall 2013 cruise, due to suspicion of a possible gear damage following a ‘bump’ felt by the crew, however no damage was found.

At each station, several standard variables were recorded. These included:

- *Station identification parameters* - date, station number, stratum, station sampling cell number.
- *Tow parameters* - beginning & ending tow location, vessel speed & direction, engine RPMs, duration of tow, water depth, current direction.
- *Gear identification and operational parameters* - net type code & net number, door type code & door numbers, tow warp length, trawl door spread, wing spread, headline height & bottom contact of the footgear.
- *Atmospheric and weather data* - air temperature, wind speed & direction, barometric pressure, relative humidity, general weather state, sea state.
- *Hydrographic data* - water temperature, salinity, dissolved oxygen, pH.

Upon arrival at a sampling site, the Captain and Chief Scientist jointly determined the desired starting point and path for the tow. To further decrease the possibility of sampling bias, beginning with the spring 2013 cruise the approximate starting point of the tow within the sampling cell was randomly pre-assigned at one of the cell’s corners. However, flexibility was allowed with regard to both the starting point and the tow path so that a complete tow (i.e., 20 minutes in duration) could be executed while remaining within the boundaries of the defined cell.

Vessel crew personnel were responsible for all of the fishing-related aspects of the survey (gear handling, maintenance, repair, etc.). The Captain and Chief Scientist were charged with determining the amount of wire to be set by the winches; for a given tow, the lengths deployed from each winch were equal and a function of water depth (Table 3). One scientist was present in the wheelhouse during deployment and retrieval of the trawl. For the set-out, the Captain would signal when the winch breaks were engaged; this marked the beginning time of the tow. At this point, the scientist would activate the Netmind software, the tow track recording software, and the digital countdown timer clock (used to record tow time).

Table 3. Relationship between warp length and water depth used by the NEAMAP SNE/MA Near Shore Trawl Survey.

Water Depth (m)	Warp Length (fm)
<6.1	65
6.1 - 12.2	70
12.2 - 36.6	75
>36.6	100

At the conclusion of each tow, the scientist signaled the Captain when the clock reached zero time, haul-back commenced, and the Netmind and tow track programs were stopped. Average headrope height and wingspread were then calculated to assess tow validity. Assuming that gear performance was acceptable, vessel crew dumped the catch into one of two sorting checkers (depending on the size of the catch) for processing. Otherwise, a re-tow of the sampling site would be initiated (this was not necessary in 2013).

Hydrographic data (water temperature, salinity, dissolved oxygen) were recorded at the end of each tow while the vessel was stationary and the fishing crew emptied the catch. This protocol was developed as a time-saving mechanism; prior to 2010 these data were collected preceding setting the gear, resulting in a pause in net streaming (and therefore survey operations) while instruments were deployed and these data were recorded. Measurements were taken at approximately 1 m below the surface, at 2m of depth, then at approximately 2m depth intervals, and finally at 0.5 m to 1 m above the bottom. Beginning with the fall 2013 cruise a sensor measuring photosynthetically active radiation (PAR) was deployed simultaneously with the hydrographic instrument. However, after the cruise a fault was discovered in the time-syncing of the two devices so it was impossible to assign accurate depths to the PAR readings which rendered them unusable. This fault will be corrected for future cruises.

Each catch was sorted by species and modal size group (e.g., small, medium, and large size) within species. Aggregate biomass (kg) and individual length measurements were recorded for each species-size group combination of the Priority 'D' species. For Priority 'A' species, a subsample of five individuals from each size group was selected for full processing (see next paragraph). For some very common Priority 'A' species including Spot (*Leiostomus xanthurus*), butterfish (*Peprilus triacanthus*), skates, and dogfishes, only three individuals per size group were sampled for full processing.

Data collected from each of these subsampled specimens included individual length (mm fork length where appropriate, mm total length for species lacking a forked caudal fin, mm pre-caudal length for sharks and dogfishes, mm disk width for skates), individual whole and eviscerated weights (measured in grams, accuracy depended upon the balance on which individuals were measured), and macroscopic sex and maturity stage (immature, mature-resting, mature-ripe, mature-spent) determination. Stomachs were removed (except for Spot and butterfish; previous sampling indicated that little useful data could be obtained from the stomach contents of these species) and those containing prey items were preserved for subsequent examination. Otoliths or other appropriate ageing structures were removed from each subsampled specimen for later age determination. For the Priority 'A' species, all specimens not selected for the full processing were weighed (aggregate weight), and individual length measurements were recorded as described for Priority 'D' species above.

Following the recommendation of the peer review panel, the NEAMAP SNE/MA Survey began recording individual length, weight, and sex from an additional 15 specimens per size-class per species per tow from the following fishes: Black Sea Bass (*Centropristis striata*), Summer Flounder (*Paralichthys dentatus*), Striped Bass (*Morone saxatilis*), Winter Flounder

(*Pseudopleuronectes americanus*), skates, and dogfishes. These species were chosen because either they are known to exhibit sex-specific growth patterns or sex determination through the examination of external characters is possible.

Additional data are recorded from several species which initially were classified as Priority 'D' species but later became Priority 'E.' The number of species and the number of additional data elements recorded both continue to increase. These include:

- American Lobster: Since the spring 2010 cruise the following parameters have been recorded for a large subsample of specimens:
 - Individual length and weight
 - Sex and maturity
 - Presence/Absence of shell disease
 - Presence/Absence of berries/eggs (only females)
 - Egg stage (only females with eggs)
 - Presence/Absence of a v-notch (only females)
 - Following publication of a possible method to determine lobster age (Kilada at al., 2012), in spring 2013 a small number of 'gastric mill' structures were removed and preserved for future analysis. Should the method prove reliable this will become a routine part of the NEAMAP SNE/MA sampling protocol.
- Horseshoe Crab:
 - Since the initial NEAMAP SNE/MA cruise a subsample of specimens was selected for determination and recording of sex so that sex-specific analyses could later be performed.
 - In addition, beginning with the spring 2011 cruise, maturity and reproductive status (i.e. evidence of prior spawning) were ascertained for these same subsampled specimens.
- Longfin Inshore Squid:
 - Beginning with the spring 2013 cruise a subsample of specimens was selected for determination of sex and maturity stage. Unlike most fish species however, maturity stage is not readily apparent by simple examination. For each sex, four different external and internal measurements must be recorded and then maturity can be inferred and assigned using a regression method (Macy, 1982) during post processing of data.

Nearly all biological and some physical data were recorded electronically at sea. Electronic data collection procedures for the NEAMAP SNE/MA survey have gone through several iterations and continue to evolve. During spring 2013 a new data entry and editing program, the Fisheries Environment for Electronic Data (FEED) was introduced. This program was developed under direction of personnel at VIMS and specific applications can be developed for virtually any data entry/editing need. The program accepts data directly from several different electronic measuring boards as well as any device which sends data through a COM port (e.g. balances). Even though electronic data collection has always been used on NEAMAP SNE/MA cruises, this new application has decreased processing time both at-sea and during post-cruise operations at VIMS.

In the event of a large catch, appropriate subsampling methods were implemented (Bonzek *et al.* 2008). In accordance with recommendations of the NEAMAP SNE/MA peer review panel, improved subsampling methods to more closely approximate random sampling procedures were implemented in 2009 and continued throughout 2013.

Laboratory Methods

Otoliths and other appropriate ageing structures were (and are in the process of being) prepared according to methodology established by the NEFSC, Old Dominion University, and VIMS. Typically, one otolith was selected and mounted on a piece of 100 weight paper with a thin layer of *Crystal Bond*. A thin transverse section was cut through the nucleus of the otolith, perpendicular to the sulcal groove, using two *Buehler* diamond wafering blades and a low speed *Isomet* saw. The resulting section was mounted on a glass slide and covered with *Crystal Bond*. If necessary, the sample was wet-sanded to an appropriate thickness before being covered. Some smaller, fragile otoliths were read whole. Both sectioned and whole otoliths were most commonly viewed using transmitted light under a dissecting microscope. Other structures such as vertebrae, opercles, and spines were processed and read using the standardized and accepted methodologies for each. For all hard parts, ages were assigned as the mode of three independent readings, one by each of three readers, and were adjusted as necessary to account for the timing of sample collection and mark formation.

Stomach samples were (and are being) analyzed according to standard procedures (Hyslop 1980). Prey items were identified to the lowest possible taxonomic level. Experienced laboratory personnel are able to process, on average, approximately 60 to 70 stomachs per person per day.

Analytical Methods

Abundance Indices: The methodology employed to calculate relative abundance indices for the NEAMAP SNE/MA survey has evolved with nearly every annual report and is still being developed.

- Initially, as it was considered impractical to report point estimates with only one or two data points, abundance was reported as ‘minimum trawlable abundance’ by state. These were area-expanded area-swept calculations and helped show the general pattern of distribution of species of interest (Bonzek *et al.*, 2007).
- Catch data from fishery-independent trawl surveys tend not to be normally distributed. Preliminary analyses of NEAMAP SNE/MA data showed that, at least for some species, these data followed a log-normal distribution. As a result, following reports utilized the stratified geometric mean of catch per standard area swept, including catch data from all stations for every species so analyzed, as an appropriate form for the abundance indices generated by this survey (Bonzek *et al.* 2009).
- The next iteration involved making two simultaneous changes to the methodology used for calculating abundance indices. First, due to the small number of years sampled through 2009, as stated above, prior abundances had been calculated using data from all survey strata, for all species. Given the broad geographic range of the survey, for

many species this resulted in a larger than necessary number of zero values entering the calculation, as some species were rarely captured in many survey strata. These zero values both unnecessarily biased point estimates and inflated variance estimates. In 2010-2011 it was considered that enough data had been gathered over relatively warm and relatively cold years so that reasonable restrictions could be defined as to which strata were to be used for each species. Therefore strata were selected for inclusion and exclusion on a species by species basis (these defined strata can still be refined as more data are gathered in future years).

- For the current report, abundance estimates are presented as the (back-transformed) geometric mean, using only the strata of importance for each species.

For a given species, its abundance index for a particular survey cruise is given by:

$$\hat{N} = \exp\left(\sum_{s=1}^{n_s} \hat{A}_s \hat{N}_s\right) \quad (1)$$

where n_s is the total number of strata in which the species was captured, \hat{A}_s is an estimate of the proportion of the total survey area in stratum s , and \hat{N}_s is an estimate of the loge transformed mean catch (number or biomass) of the species per standard area swept in stratum s during that cruise. The latter term is calculated using:

$$\hat{N}_s = \frac{\sum_{t=1}^{n_{t,s}} \log_e\left(\frac{c_{t,s}}{\hat{a}_{t,s}/25000}\right)}{n_{t,s}} \quad (2),$$

where $\hat{a}_{t,s}$ is an estimate of the area swept by the trawl (generated from wing spread and tow track data) during tow t in stratum s , $25,000\text{m}^2$ is the approximate area swept on a typical tow (making the quantity $[\hat{a}_{t,s} / 25000]$ approximately 1), $n_{t,s}$ is the number of tows t in stratum s that produced the species of interest, and $c_{t,s}$ is the catch of the species from tow t in stratum s .

- In addition to the overall abundance estimates, for several species in this report, either separate young-of-year (YOY) or several age-specific indices are also reported.
 - For species for which either a reliable literature source or examination of NEAMAP SNE/MA length-frequency plots (or both) revealed a dependable single YOY length cutoff value (separately for spring and fall surveys to allow for growth) this value was used to segregate the youngest survey age class (typically age-0 in the fall and age-1 in the spring as the species passed its assigned assessment birthdate during the succeeding winter) to calculate indices for that youngest age class. These species are Alewife, Atlantic Menhaden, Blueback Herring, Silver Hake, and Smooth Dogfish. This method was also used to

generate indices for the two age-0 (spring spawn vs. summer spawn) Bluefish cohorts.

- For species for which a sufficient numbers of otoliths have been examined to allow estimation of age-length keys (ALK), these keys were developed and the proportional age-at-size assignments were made to NEAMAP SNE/MA length data and age-specific abundance indices then calculated. For certain species, aged specimens from other VIMS surveys were used either alone or in conjunction with NEAMAP SNE/MA samples to achieve adequate sample sizes. Wherever sufficient data were available, these age-specific indices were calculated for the same age classes as were used in the most recent assessments. These species are Atlantic Croaker (ages 0 – 4+), Bluefish (age 0 – spring and summer cohorts separately), Summer Flounder (ages 0 – 7+), Weakfish (ages 0 – 3+), and Winter Flounder (ages 1 – 7+).

In the most recent prior NEAMAP SNE/MA report ALKs used to calculate age-specific abundance indices were pooled over all years for which data were available for any given species. In coordination with procedures used at NEFSC, analyses in the current report use year-specific ALKs for all cases for which reliable such ALKs can be determined from survey data. For years for which ageing has not yet been completed (usually the most recent years) or for species for which an inadequate number of ages exists within a single year (e.g. Black Sea Bass), ALKs pooled over all years or over a subset of years were used.

- NEAMAP SNE/MA investigators are still evaluating alternatives for abundance index calculation. Preliminary examination of NEAMAP SNE/MA catches indicates that for at least some species a delta lognormal based index may best fit the underlying statistical distribution of catches. While these investigators realize that these several changes can result in a certain amount of confusion by users of these data, it is still early in the NEAMAP SNE/MA time series and it is considered preferable to eventually make these calculations as statistically robust as they can be rather than to too-early settle on an inferior methodology simply for the sake of consistency. It was hoped that these investigations could have been completed in time for the present annual report but this was not possible.

Length-Frequency: Length-frequency histograms were constructed for each species by survey cruise using 1cm or 0.5cm length bins (depending on the size range of the species). These were identified using bin midpoints (e.g., a 25cm bin represented individuals ranging from 24.5cm to 25.4cm in length). Although these histograms are presented by survey cruise, the generation of length-frequency distributions by year, sex, sub-area, overall, and a number of other variables, is possible.

For this and several other stock parameters, data from specimens taken as a subsample (either for full processing or in the event of a large catch) were expanded to the entire sample (i.e., catch-level) for parameter estimation. Because of the potential for differential rates of

subsampling among size groups of a given species, failure to account for such factors would bias resulting parameter estimates. In the NEAMAP SNE/MA database, each specimen was assigned a calculated expansion factor, which indicated the number of fish that the individual represented in the total sample for the station in which the animal was collected.

Age-Structure: Age-frequency histograms were generated by cruise for each of the Priority ‘A’ species for which age data are currently available (i.e., processing, reading, and age assignment has been completed). These distributions were constructed by scaling the age data from specimens taken for full processing to the catch-level, using the expansion factors described above. Again, while the age data are presented by survey cruise, the generation of these age-structures by year, sex, sub-area, overall, and a number of other variables (or a combination of these variables), is possible. For species and years for which ages have not yet been included in the data base, ages were assigned by applying a year-pooled ALK to the length data. Note that the maximum age assigned by an ALK may be significantly younger than the maximum age attained by a species.

Diet Composition: It is well known that fishes distribute in temporally and spatially varying aggregations. The biological and ecological characteristics of a particular fish species collected by fishery-independent or -dependent activities inevitably reflect this underlying spatio-temporal structure. Intuitively, it follows then that the diets (and other biological parameters) of individuals captured by a single gear deployment (e.g., NEAMAP SNE/MA tow) will be more similar to one another than to the diets of individuals captured at a different time or location (Bogstad *et al.* 1995).

Under this assumption, the diet index percent by weight for a given species can be represented as a cluster sampling estimator since, as implied above, trawl collections essentially yield a cluster (or clusters if multiple size groups are sampled) of the species at each sampling site. The equation is given by (Bogstad *et al.* 1995, Buckel *et al.* 1999):

$$\%W_k = \frac{\sum_{i=1}^n M_i q_{ik}}{\sum_{i=1}^n M_i} * 100 \quad (3),$$

where

$$q_{ik} = \frac{w_{ik}}{w_i} \quad (4),$$

And where n is the total number of clusters collected of the fish species of interest, M_i is the number of that species collected in cluster i , w_i is the total weight of all prey items encountered in the stomachs of the fish collected and processed from cluster i , and w_{ik} is the total weight of prey type k in these stomachs.

This estimator was used to calculate the diet compositions of the NEAMAP SNE/MA Priority 'A' species (for those where diet data are currently available); the resulting diet descriptions are included in this report. Again, while these diets reflect a combination of data collected from the eleven full-scale survey cruises, presentations of diet by sub-area, year, cruise, size, age, etc., are possible (for those where diet data are currently available); the resulting diet descriptions are included in this report.

The percent weight (%W), percent number (%N) indices are each useful in different contexts so both are presented here. For %W and %N, only those specific prey types that reach a 1% threshold in the overall diet are shown individually. All others are summed into broader taxonomic categories (On the figures showing diets for each species, prey items which were identified to a low taxonomic level but which did not reach the 1% threshold are combined in categories labeled 'xxxxxx-other' where 'xxxxx' represents a broad taxonomic group such as crustaceans. In combination these prey types may reach well beyond the 1% threshold. Prey items that could not be identified below a broad taxonomic level are labeled 'unid xxxxxx'). Further, for these indices, closely related prey types (e.g. different species of mysids or of amphipods) are generally summed and reported together as a group.

In each diet composition figure, prey types are ordered first in descending order of percentage by weight by broad taxonomic category (e.g. fishes, crustaceans, molluscs) and within each category by descending order by weight of each specific prey type. For clarity and ease of comparison, the same order of broad taxonomic groups is maintained in the %N figure even though this may not reflect the true decreasing order by that measure (e.g. for some predator species, fishes may constitute a plurality of their diet by weight but smaller crustaceans may dominate by number).

Results

General Cruise Information / Station Sampling

The spring 2013 survey began on 25 April and ended on 23 May, while the fall cruise spanned from 1 October to 11 November. All 150 sites were sampled during each of these surveys. The number of primary and alternate sites sampled during each cruise is given both by region and overall (Table 4). At the cruise level, the rate at which alternate sites were substituted for primaries declined from 12%-15% in early survey years to about 8% in 2011-2013. This was to be expected as the survey personnel gained experience fishing in questionable areas and as the data base of non-towable areas improved. Among regions within a cruise, the frequency of alternate sampling continued to be variable. In particular, and as in previous years, the sampling of alternate sites in the place of primaries occurred most often in BIS and especially in RIS for both surveys. These Sounds are notorious for their bad bottom and large fixed-gear (i.e., lobster pots) areas and, as a result, finding a ‘towable lane’ within a primary cell was often not possible. Lack of familiarity with these waters was also an issue; the captain of the survey vessel had not fished in these sounds prior to his involvement with NEAMAP SNE/MA. While the survey protocol calls for sampling of the closest suitable alternate in the event of an untowable primary, this was often not possible in the Sounds for the same reasons outlined above. It is anticipated that the rates of substitution of alternates for primaries in BIS and RIS will continue to decline in future cruises, as NEAMAP SNE/MA continues to accumulate information on known towable and untowable locations in these waters through both survey experience and cooperation with local industry representatives.

Outside of the Sounds, the rate of alternate sampling tended to be low though somewhat variable. The sampling of alternates in the more northern portion of the survey range (i.e., off of New York and New Jersey) was mainly due to rocky bottom and the presence of wrecks, while issues related to water depth (specifically, the lack of), were the most common cause of alternate substitution off of Virginia and North Carolina.

Table 4. Number of sites sampled in each region during the spring and fall 2013 NEAMAP SNE/MA cruises. The numbers of primary and alternate sites sampled in each region are given in parentheses.

Region	Spring 2013 Total - (Prim. / Alt.)	Fall 2013 Total - (Prim. / Alt.)	Region	Spring 2013 Total - (Prim. / Alt.)	Fall 2013 Total - (Prim. / Alt.)
RI Sound	16 - (11 / 5)	16 - (11 / 5)	8	9 - (9 / 0)	9 - (9 / 0)
BI Sound	10 - (10 / 0)	10 - (8 / 2)	9	17 - (16 / 1)	17 - (17 / 0)
1	2 - (2 / 0)	2 - (2 / 0)	10	10 - (10 / 0)	10 - (9 / 1)
2	5 - (5 / 0)	5 - (4 / 1)	11	13 - (12 / 1)	13 - (11 / 2)
3	5 - (5 / 0)	5 - (5 / 0)	12	9 - (9 / 0)	9 - (9 / 0)
4	5 - (5 / 0)	5 - (5 / 0)	13	16 - (16 / 0)	16 - (15 / 1)
5	5 - (3 / 2)	5 - (5 / 0)	14	7 - (7 / 0)	7 - (7 / 0)
6	5 - (5 / 0)	5 - (4 / 1)	15	6 - (6 / 0)	6 - (4 / 2)
7	10 - (9 / 1)	10 - (9 / 1)	Total	150 - (140 / 10)	150 - (134 / 16)

Water Temperature

Because of the relatively narrow near shore band of water sampled by NEAMAP SNE/MA, catches can be influenced by environmental factors that affect the movement of fish into and out of the sampling area. Most likely, bottom temperature is a driving force in the distribution and availability of many species. For each cruise, geographic information system (GIS) figures are provided which summarize the bottom temperature data recorded at each station with interpolation among stations (Figures 3A-3M). Each figure has three representations of temperature data: a) a figure at the top of each page gives the bottom temperatures averaged over all spring or fall cruises (as appropriate), b) interpolated actual measurements from the cruise, and c) a figure with the difference between a and b. From these figures the following general patterns are apparent from visual examination:

- Spring 2008: Warmer than average through nearly the entire sampling range.
- Spring 2009: Most areas were cooler than average except in southern NY and northern NJ.
- Spring 2010: Below average bottom temperatures except in the middle portion of the sampling range between mid-NJ and VA.
- Spring 2011: Somewhat below average temperatures were seen up and down the coast.
- Spring 2012: Warmer than average temperatures during the entire survey period.
- Spring 2013: Cooler than average temperatures throughout the survey range.
- Fall 2007: Below average temperatures were found in RIS, BIS, to a point about halfway down Long Island and considerably above average temperatures below that point
- Fall 2008 temperatures were measured as about average to below average in the middle portion of the sampling range (mid Long Island south to Delaware) and somewhat-to-very above average to the north and south.
- Fall 2009: The 2007 pattern was exactly reversed with above average temperatures found in RIS and BIS and cool to very cool from there southward.
- Fall 2010: Average-to-slightly-below-average temperatures through the sampling area.
- Fall 2011: Near average in most locations except for a patch of very cold water at deeper stations in RIS.
- Fall 2012: Similar to Fall 2011 with average-to-slightly-below-average temperatures throughout the range.
- Fall 2013: Cooler than average temperatures throughout the survey range.

An analysis not presented in previous project reports interpolates all of the water column temperature data within each of several survey areas (Figure 4). Though these figures can be difficult to interpret as the temperature range does not match that of those in Figure 3, they do demonstrate that temperature is quite variable throughout the water column and over the geographic range of the survey.

It is expected/hoped that future analyses of such environmental variability can help explain variability in survey catches and could even be incorporated into abundance index calculations.

Gear Performance

The NEAMAP SNE/MA Trawl Survey currently owns three nets (identical in design and construction), with a fourth one currently being constructed. Generally, NEAMAP SNE/MA has used one of these nets during the spring cruises and a second net during fall sampling (to date, the third existing net has yet to be fished) and this held true during 2013. The ‘fall net’ (designated net #G01) had its bottom bellies replaced, due to normal wear and tear, prior to 2010 sampling. Likewise the ‘spring net’ (#G02) underwent extensive repairs (bottom bellies, footrope, sweep, and traveler wires, up and down lines all replaced) due to its being torn in half off of the coast of New Jersey during the 107th tow of the spring 2009 survey. This net was returned to the manufacturer to be rebuilt according to the original specifications. Both of these nets were subjected to the NEAMAP SNE/MA gear certification process before being returned to service (Bonzek *et al.* 2008). VIMS currently owns two pairs of Thyboron type IV 66” trawl doors though only one set has been used for sampling thus far. No excessive wear and tear has been experienced, though the rear ‘knife edges’ upon which the doors ride along the bottom are replaced prior to each survey.

As was observed during the pilot cruises and all previous full-scale surveys, the NEAMAP SNE/MA survey gear performed consistently and within expected ranges during the spring and fall 2013 cruises and do not exhibit any substantial differences in configuration among the four NEAMAP SNE/MA depth strata (Figure 5A, 5B). The cruise averages for door spread (33.1m spring, 31.7 m fall), wing spread (13.9m spring, 13.4 m fall), and headline height (5.4m spring, 5.6 m fall) were within optimal ranges for the both 2013 cruises. Average towing speed was 3.1 kts and 3.0 kts for the spring and fall cruises respectively. For both cruises, the overwhelming majority of the station averages for each of these parameters fell within the optimal ranges. Because all fell within the acceptable ranges, it was not necessary to disregard any tows due to poor net performance.

Catch Summary

Over 1,144,000 individual specimens (fishes and invertebrates) weighing approximately 67,000 kg and representing 135 species, including boreal, temperate, and tropical fishes, were collected during the two surveys conducted in 2013 (Table 5, Table 6). As expected, catches were larger and more diverse on the fall surveys relative to the spring cruises. In all, individual length measurements were recorded for 184,484 animals. Lab processing is proceeding on the 7,317 stomach samples and 11,285 ageing structures (otoliths, vertebrae, spines, opercles) collected in the field. As of the date of this report, stomachs from all cruises except for fall 2013 have been examined and prey contents identified and quantified. Likewise, preparation of ageing structures is proceeding for all species and all cruises. As a result of a restructuring of responsibilities within the survey/lab analysis team, significant progress has been made in addressing a backlog of otolith processing. For specimens collected in 2013, ageing has been completed for Black Sea Bass, Summer Flounder, Bluefish, and Weakfish (i.e. species either of high management interest or scheduled for assessment in the near future). Ages have yet to be assigned for many species, especially elasmobranchs, as methodology must be verified.

A change has been implemented in ageing protocols to improve the accuracy of age determination. As noted in previous reports the NEAMAP SNE/MA protocol was to process all age structures collected from a given species in a given year at one time (i.e., spring and fall samples processed together after the fall survey). The aforementioned protocol was in place to facilitate 'blind reading' of these samples to avoid bias. Previously only the senior readers had information about the catch time and location because they must interpret otolith edge patterns in the context of the season in which the specimen was captured. As experience has been gained however, it became apparent that each reader must be aware of the season and general latitude of capture in order to correctly interpret edge patterns in relation to the time of annulus formation. No readers are aware of the specimen's size or sex.

To assure consistency in ageing methodologies across programs, sample exchanges have been implemented between NEAMAP SNE/MA staff at VIMS and fish ageing personnel at the NEFSC's Fishery Biology Program in Woods Hole, MA.

Further, for two species (Scup and Black Sea Bass) for which differing structures have been used both within and among fish ageing groups, an ongoing effort has been implemented by NEAMAP SNE/MA personnel to assess potential differences between ages as determined by scales and otoliths (both whole and sectioned). Results should be available in 2014.

Table 5. For each species collected during the NEAMAP SNE/MA spring 2013 cruise, the total number and biomass of specimens caught, number measured for individual length, number sampled for ageing, and number of stomachs collected that contained prey. Species are grouped by priority level.

Priority "A" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
alewife	1,368	73.1	1,137	213	207
American shad	2,755	73.4	2,210	371	366
Atlantic cod	3	5.8	3	3	3
Atlantic croaker	41,571	3,098.7	4,487	297	200
Atlantic herring	322	16.2	322	48	42
Atlantic mackerel	12	0.5	12	12	10
Atlantic menhaden	3,181	129.0	943	133	133
barndoor skate	3	1.6	3		
black drum	2	29.9	2	2	2
black seabass	498	146.7	498	229	185
blueback herring	4,484	72.0	3,430	178	169
bluefish	12	22.6	12	12	6
butterfish	10,476	678.6	6,033	457	
clearnose skate	2,309	3,072.5	1,715	250	216
goosefish	16	45.6	16	16	11
little skate	10,991	5,232.1	5,532	371	313
scup	9,755	1,555.7	4,083	553	335
silver hake	4,843	178.9	3,751	526	488
smooth dogfish	411	1,236.1	411	176	165
spiny dogfish	1,838	4,227.8	1,738	371	233
spot	71,460	2,572.1	10,725	260	
striped bass	37	148.2	37	36	19
summer flounder	520	271.7	520	303	155
tautog	17	23.3	17	17	13
weakfish	3,404	269.9	2,019	386	274
windowpane	904	187.7	840	339	212
winter flounder	978	391.3	978	326	278
winter skate	3,029	3,419.3	2,915	416	348
yellowtail flounder	15	6.6	15	11	9
TOTAL	175,214	27,186.8	54,404	6,312	4,392

Table 5. continued.

Priority "D" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
Atlantic brief squid	42	0.6	42		
Atlantic cutlassfish	1,837	17.3	365		
Atlantic rock crab	111	10.7	111		
Atlantic thread herring	4	0.1	4		
banded drum	2	0.1	2		
bay anchovy	59,035	189.1	9,741		
blackcheek tonguefish	34	1.2	34		
common spider crab	167	24.5	167		
conger eel	1	0.8	1		
cunner	10	2.0	10		
eyed flounder	3	0.0	3		
fourspot flounder	341	59.0	341		
Gulf Stream flounder	32	1.0	32		
harvestfish	374	9.9	374		
hickory shad	3	0.4	3		
hogchoker	32	3.4	32		
kingfish (Menticirrhus spp.)	2,309	189.1	1,927	75	70
knobbed whelk	2	1.0	2		
lady crab	72	2.0	72		
longfin inshore squid	2,078	103.0	2,078		
longhorn sculpin	63	15.8	63		
mantis shrimp	7	0.4	7		
northern puffer	233	41.7	233		
northern searobin	343	27.7	343		
northern stargazer	2	2.1	2		
ocean pout	39	48.2	39		
oyster toadfish	2	0.2	2		
pigfish	8	0.4	8		
pinfish	13	0.2	4		
red hake	975	67.8	975		
sea raven	7	6.0	7		
sea scallop	79	4.9	79		
silver perch	1,472	39.6	506	2	2
six spine spider crab	3	0.8	3		
smallmouth flounder	23	0.2	23		
spotted hake	30,596	519.5	7,897		
striped anchovy	611	4.7	430		
striped cusk-eel	7	0.3	7		
striped searobin	830	212.8	509		
white hake	2		2		
white shrimp	109	2.8	109		
TOTAL	101,913	1,611.6	26,589	77	72

Table 5. continued.

Priority "E" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American lobster	230	67.9	230	27	
Atlantic stingray	1	0.3	1		
Atlantic sturgeon	8	168.0	8		
Atlantic torpedo	1	7.7	1		
blue crab, adult female	11	1.3	11		
blue crab, juvenile female	2	0.2	2		
bluntnose stingray	5	11.5	5	2	2
horseshoe crab	933	734.0	933		
jonah crab	2	0.1	2		
little & winter skates	2,299	359.5	1,308		
sandbar shark	1	1.0	1		
TOTAL	3,493	1,351.5	2,502	29	2

Priority "F" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
blue mussel	21	1.2			
grass shrimp	125	0.3			
moon snail	7	0.5			
sand shrimp	130	0.4			
sea mouse	1	0.0			
unidentified hermit crab	17	0.3			
unidentified jellyfish		1.3			
unidentified sea stars	1	0.0			
unidentified spider	7	1.1			
TOTAL	309	5.1	N/A	N/A	N/A
CRUISE TOTAL	280,929	30,155.0	83,495	6,418	4,466

Table 6. For each species collected during the NEAMAP SNE/MA fall 2013 cruise, the total number and biomass of specimens caught, number measured for individual length, number sampled for ageing, and number of stomachs collected that contained prey. Species are grouped by priority level.

Priority "A" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
alewife	2	0.1	2	2	1
Atlantic croaker	97,463	10,425.9	8,574	295	202
Atlantic herring	1,249	14.2	136	35	28
Atlantic mackerel	1	0.1	1	1	1
Atlantic menhaden	33	8.1	33	32	31
barndoor skate	3	2.9	3		
black drum	19	2.9	19	19	5
black seabass	572	218.3	572	182	148
blueback herring	152	8.3	152	5	4
bluefish	3,173	329.7	2,428	392	250
butterfish	433,403	5,906.1	21,296	661	
clearnose skate	906	1,182.1	906	291	264
goosefish	3	17.1	3	3	2
haddock	4	0.1	4	4	4
little skate	4,480	2,429.4	3,606	267	229
red drum	3	36.3	3	3	3
scup	43,604	857.1	5,622	372	308
silver hake	568	5.6	568	140	75
smooth dogfish	549	770.3	459	174	170
Spanish mackerel	1	0.1	1	1	1
spiny dogfish	477	992.6	185	29	22
spot	19,818	1,871.7	4,827	218	
spotted seatrout	5	0.8	5	5	3
striped bass	113	621.8	113	21	10
summer flounder	335	142.9	335	303	158
tautog	6	3.5	6	6	6
weakfish	24,265	1,596.8	8,982	607	390
windowpane	416	63.4	416	244	154
winter flounder	150	60.4	150	93	61
winter skate	1,535	1,644.3	981	169	134
TOTAL	633,308	29,213.0	60,388	4,574	2,664

Table 6. continued.

Priority "D" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American eel	3	4.8	3		
Atlantic brief squid	1,319	11.4	968		
Atlantic cutlassfish	240	21.4	240		
Atlantic hagfish	5	0.4	5	5	1
Atlantic moonfish	4,832	33.8	1,780		
Atlantic rock crab	3	0.7	3		
Atlantic spadefish	34	0.8	34		
Atlantic thread herring	1	0.0	1		
Atlantic threadfin	1	0.0	1		
banded drum	14	0.1	14	1	
bay anchovy	52,635	158.1	7,631		
bigeye scad	37	0.6	37		
blackbelly rosefish	4	0.3	4		
blackcheek tonguefish	7	0.2	7		
blue runner	31	1.2	31		
bluespotted cornetfish	3	0.1	3		
brown shrimp	8	0.2	8		
chub mackerel	3	0.4	3		
common spider crab	14	2.4	14		
crevalle jack	1	0.2	1		
cunner	4	1.1	4		
fourspot flounder	71	12.2	71		
fringed flounder	7	0.2	7		
gray triggerfish	4	2.0	4		
groupers	1	0.0	1		
Gulf Stream flounder	10	0.3	10		
harvestfish	2,030	95.3	436		
hickory shad	3	1.0	3		
hogchoker	59	5.4	59		
inshore lizardfish	24	2.7	24		
kingfish (Menticirrhus spp.)	6,805	958.8	2,458	101	73
knobbed whelk	2	0.7	2		
lady crab	57	3.6	57		
lined seahorse	2	0.0	2		
longfin inshore squid	112,240	1,969.4	15,539		
lookdown	1	0.0	1		
mantis shrimp	12	0.4	12		
northern puffer	175	27.9	175		
northern searobin	90	7.4	90		
northern sennet	22	1.6	22		
northern stargazer	8	7.8	8		
Ovalipes lady crab	1	0.1	1		
oyster toadfish	1	0.7	1		
pigfish	1,216	66.2	961		
pinfish	226	7.9	226	29	9
red goatfish	6	0.1	6		
red hake	29	3.3	29		
rough scad	149	3.7	149		
round herring	233	5.7	233		
round scad	186	1.4	186		
sand lances	18	0.3	18		
sea raven	3	4.5	3		
sea scallop	74	4.0	74		
sheepshead	147	201.7	147	3	2
short bigeye	2	0.1	2		
silver jenny	1	0.0	1		
silver perch	1,716	46.8	1,546	52	35
silver seatrout	1	0.1	1		
smallmouth flounder	19	0.4	19		
spotfin mojarra	3	0.0	3		
spotted hake	1,222	133.3	1,222	74	60
striped anchovy	40,977	587.8	4,180		
striped burrfish	15	6.7	15		
striped cusk-eel	7	0.3	7		
striped searobin	239	81.7	239		
white shrimp	974	22.5	534		
TOTAL	228,287	4,514.1	39,576	265	180

Table 6. continued.

Priority "E" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
American lobster	59	19.7	59		
Atlantic angel shark	29	209.9	29		
Atlantic stingray	8	3.2	8		
Atlantic sturgeon	5	121.8	5		
Atlantic torpedo	1	9.3	1		
blue crab, adult female	7	1.2	7		
bluntnose stingray	15	50.5	15		
bullnose ray	211	165.3	211	9	4
cownose ray	189	312.4	189	9	3
horseshoe crab	298	489.2	298		
jonah crab	13	1.2	13		
Kemp's ridley sea turtle	7	25.1	7		
little & winter skates	37	6.0	37		
rougthead stingray	11	137.1	11		
sand tiger shark	3	133.2	3		
sandbar shark	28	107.7	28		
smooth butterfly ray	57	108.2	57	6	
spiny butterfly ray	37	113.5	37	4	
thresher shark	10	285.5	10		
TOTAL	1,025	2,299.9	1,025	28	7

Priority "F" Species					
Species	Total Number Collected	Total Species Weight (kg)	Number Measured	Number for Ageing	Number of Stomachs
blue mussel	530	104.5			
lions mane jellyfish		8.5			
moon jelly		152.4			
potato sponge (monkey dung)		29.7			
sand dollar	6	0.1			
squid egg mop		3.1			
unidentified comb jelly	4	0.5			
unidentified jellyfish		90.6			
unidentified sea stars	2	0.0			
TOTAL	542	389.5	N/A	N/A	N/A
CRUISE TOTAL	863,162	36,416.4	100,989	4,867	2,851

Species Data Summaries

The data summaries presented in this report include the information collected on each of the NEAMAP SNE/MA Trawl Survey full-scale cruises conducted to date and focus on species that are of management interest to the Mid-Atlantic Fishery Management Council. Some that are of interest to the New England Fishery Management Council and the ASMFC, or that are not managed but considered valuable from an ecological standpoint, are also included. Data summaries for several species which were not included in previous reports due to the relatively small numbers captured during NEAMAP SNE/MA cruises are presented in this report (American Goosefish, Atlantic Cod, Black Drum, Sandbar Shark, Smooth Butterfly Ray, Spiny Butterfly Ray, Tautog, Yellowtail Flounder).

It is important to note that these summaries represent only a subset of the biological and ecological analyses that are feasible using the data collected by the NEAMAP SNE/MA Survey. Several additional analyses are possible for each of the species included in this report, as well as for others that have been collected by this survey but are not presented. Some analyses (e.g., length-weight relationships, growth curves) found in previous reports are excluded here in an effort to make the scope of this document somewhat manageable. Certainly, any NEAMAP SNE/MA information (data or analyses) requested by assessment scientists and managers would be made available in a timely manner.

For a small subset of species that are not captured in large numbers but are of particular interest or concern (Atlantic sturgeon – Figure 6A, sea turtles – Figure 6B, and coastal sharks – Figure 6C) single-page summaries of NEAMAP SNE/MA catches over all survey years are presented, showing geographic locations and numbers in a GIS format.

Although this report focuses on the data collected during 2013, some information from previous years is included in these species summaries to both place the 2013 data in context as well as to increase sample sizes. Relative indices of abundance are given for most species included in this report and are presented by survey (spring or fall) as stratified geometric mean of catch per standard area swept. The total number and biomass collected, number sampled for individual length measurements, and numbers taken and processed for age determination and diet composition (Priority 'A' species only) are also given for each cruise. Catch distribution plots and length-frequencies are provided for these species on a per-cruise basis. For most species, especially those with documented sexual dimorphic growth patterns, sex-specific length frequency histograms are given, and sex ratios by size are presented for all Priority 'A' species as well as for some of the invertebrates, and were generated by combining data across all cruises (spring and fall separately). Age-frequency distributions (by cruise) and maturity rate regressions (all cruises combined), and diet compositions (all cruises combined) are also included for these priority species where field collections and subsequent laboratory progress have resulted in sufficient sample sizes.

For most species, the following tables and figures are presented:

- GIS figures showing the biomass of that species collected at each sampling site for each of the 2013 cruises. These figures, along with a separate table given alongside, also highlight the strata used for index calculation separately for spring and fall surveys.
- A table presenting, for each cruise, the total number of specimens of that species collected, total biomass of these individuals, number sampled for individual length measurements, number taken for full processing (including age and stomach analysis), and the number of age and stomach samples processed to date.
- A table is shown with relative abundance indices (number and biomass) calculated as stratified geometric mean of catch per standard area swept, for all ages/sizes combined; additionally for species for which a reasonable basis for separating either the youngest age class present in the data (usually either 0 or 1) existed or age-specific data were available, separate indices are presented for these subgroupings as well. Sample sizes (number of stations used for index calculation) and lower and upper 95% confidence limits are also,
- Figures displaying stratified geometric mean catch per standard area swept (both number and biomass) for each cruise given (confidence limits are not displayed on the figures as they tend to mask trends in the indices due to expansion of the y-axis scale).
- Length-frequency histograms, by cruise.
- Sex-specific length-frequency histogram for each cruise.
- Age-frequency histograms for each cruise, indicating the number caught at each age along with the year-class associated with each age group (Priority 'A' only, when available). Where necessary (e.g. for species for which ages have yet to be assigned for the most recent years), age-frequencies calculated through application of pooled ALKs are shown (in contrasting color to those from actual aged specimens). The y-axis for these plots is scaled separately for each year.
- Age-frequency bubble plots, standardized to 3,000 trawl-minutes (20 minutes per tow x 150 tows per cruise x 2 cruises) for each cruise. Data shown are similar to the age-frequency histograms except for the trawl-minute standardization and a uniform scaling process. Where necessary (e.g. for species for which ages have yet to be assigned for the most recent years), age-frequencies calculated through application of pooled ALKs are shown (in contrasting color to those from actual aged specimens). These plots allow the reader to more easily follow year class progression through time.
- Histogram of sex ratio by size group, annotated with the number of specimens examined in each size category (available only for Priority 'A' species and select invertebrates). These histograms were generated by combining data across all cruises (spring and fall separately).
- Figures presenting results of maturity logistical regression analyses by length, and where possible by age, with values given for 50% and 95% maturity, separately for each sex.
- Bar plots of diet composition by weight and by number, generated using data from all survey cruises combined (for most species, through the spring 2013 cruise, for some, through the fall 2012 cruise). The number of stomachs examined as well as the number of 'clusters' sampled (i.e., effective sample size) is provided. Diet is presented for

Priority 'A' species only, when available. Major prey taxa (crustaceans, fishes, molluscs, worms, miscellaneous) are presented in descending order by weight for each predator (i.e. the taxon with the highest percent-by-weight is the leftmost on the x-axis, the second highest is next, etc.). Within each major taxon, individual prey types are also presented in descending order, left-to-right. For consistency, the same major-taxon order is maintained for the figure which gives diet by number. Only prey types which total at least 1% of the diet are shown individually. Within a major taxon, prey types which represent less than 1% of the diet are lumped together into a 'taxon-other' category (e.g. 'crustaceans-other'). These categories are distinguished from prey types which could not be identified to a level lower than the major taxon (e.g. a prey item which could only be identified as a crustacean). For simplicity, some prey types (e.g. all amphipod species, all mysids) are lumped together even if some specimens were identified to lower taxonomic levels.

Species have been arranged alphabetically in this data summary section, and a full listing of species, along with their associated table and figure numbers, is given below (Each species is followed by a code or codes that designate the management authorities responsible: A = ASMFC, F = Federal, M = MAFMC, N = NEFMC, S = SAFMC, X = not managed or managed individually by states.). Text associated with these tables and figures is provided following this list. Detailed descriptions of these data and analyses are included for the MAFMC-managed and selected other species, while a listing of the contents of the tables and figures is given for all others.

Species list

- Alewife (A) – Page 110 - Tables 7-8, Figures 7-12.
- American Goosefish (MN) – Page 116 – Tables 9-10, Figures 13-17.
- American Lobster (A) – Page 121 - Tables 11-12, Figures 18-24.
- American Shad (A) – Page 126 – Tables 13-14, Figures 25-30.
- Atlantic Cod (N) – Page 131 – Table 15, Figures 31-33.
- Atlantic Croaker (A) – Page 134 - Tables 16-17, Figures 34-43.
- Atlantic Menhaden (A) – Page 143 - Tables 18-19, Figures 44-48.
- Bay Anchovy (X) – Page 148 - Tables 20-21, Figures 49-51.
- Black Drum (A) – Page 151 – Tables 22-23, Figures 52-57.
- Black Sea Bass (AMS) – Page 157 - Tables 24-25, Figures 58-68.
- Blueback Herring (A) – Page 166 - Tables 26-27, Figures 69-74.
- Bluefish (AM) – Page 171 - Tables 28-29, Figures 75-83.
- Brown Shrimp (S) – Page 179 - Tables 30-31, Figures 84-86.
- Butterfish (M) – Page 182 - Tables 32-33, Figures 87-94.
- Clearnose Skate (N) – Page 189 - Tables 34-35, Figures 95-101.
- Horseshoe Crab (A) – Page 195 - Tables 36-37, Figures 102-108.
- Kingfish (X) – Page 201 - Tables 38-39, Figures 109-113.
- Little Skate (N) – Page 206 - Tables 40-41, Figures 114-120.
- Longfin Inshore Squid (M) – Page 212 - Tables 42-43, Figures 121-125.

- Sandbar Shark (AF) – Page 216 – Tables 44-45, Figures 126-130.
- Scup (AM) – Page 220 - Tables 46-47, Figures 131-139.
- Silver Hake (N) – Page 228 - Tables 48-49, Figures 140-145.
- Smooth Butterfly Ray (X) – Page 234 – Tables 50-51, Figures 146-149.
- Smooth Dogfish (F) – Page 237 - Tables 52-53, Figures 150-157.
- Spanish Mackerel (AS) – Page 244 - Tables 54-55, Figures 158-161.
- Spiny Butterfly Ray (X) – Page 248 – Tables 56-57, Figures 162-165.
- Spiny Dogfish (AM) – Page 251 - Tables 58-59, Figures 166-173.
- Spot (A) – Page 258 - Tables 60-61, Figures 174-178.
- Striped Anchovy (X) – Page 263 - Tables 62-63, Figures 179-181.
- Striped Bass (A) – Page 266 - Tables 64-65, Figures 182-188.
- Summer Flounder (AM) – Page 272 - Tables 66-67, Figures 189-198.
- Tautog (A) – Page 282 - Tables 68-69, Figures 199-203.
- Weakfish (A) – Page 287 - Tables 70-71, Figures 204-213.
- White Shrimp (S) – Page 296 - Tables 72-73, Figures 214-216.
- Windowpane Flounder (N) – Page 299 - Tables 74-75, Figures 217-222.
- Winter Flounder (AN) – Page 304 - Tables 76-77, Figures 223-232.
- Winter Skate (N) – Page 314 - Tables 78-79, Figures 233-239.
- Yellowtail Flounder (N) – Page 320 – Table 80, Figures 240-243.

Alewife (*Alosa pseudoharengus*)

Figure 7. Alewife biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises, and strata used for calculation of abundance indices.

Table 7. Alewife sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 8. Alewife geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 8. Alewife geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 9. Alewife length-frequency distributions, by cruise.

Figure 10. Alewife sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 11. Alewife maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 12. Alewife diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

The NEAMAP SNE/MA survey consistently captures a far greater number of Alewives during spring surveys than during those in the fall (Table 7). During the spring, tows containing this species are spotty but are distributed throughout the survey range while during the fall positive tows are normally limited a few stations in Rhode Island Sound (Figure 7). Spring abundance indices have followed a generally declining trend. Those for fall surveys likely are not representative of the overall stock status (Table 8, Figure 8).

In most years of specimens smaller than 16cm predominate during spring surveys and are thought to be those which were spawned the previous spring (Figure 9). This will be verified when ageing of preserved otoliths is completed (NEAMAP SNE/MA personnel participated in a river herring ageing workshop during 2013 at which ageing protocols were agreed upon by representatives from several states – report *in prep.*).

In size classes up to about 22cm the sex ratio of specimens for which sex could be determined is approximately 50/50. Above that size, the ratio tends to be skewed towards females, though the current sample sizes in that range from NEAMAP SNE/MA is relatively small (Figure 10). Both males and females reach 50% maturity rates at 14-15cm (likely age-1s) and 95% maturity at 22-24cm (likely age-2s - Figure 11).

Among identifiable prey species found in Alewife stomachs, various small crustaceans account for about 55% of the diet both by weight and number. However, nearly as much unidentifiable material is found in these samples and much of that matter is likely to have come from these same small crustaceans. Worms, small fishes, and molluscs together account for only about 3-7% of the diet by weight and number, respectively (Figure 12).

American Goosefish (*Lophius americanus*)

Figure 13. American Goosefish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.

Table 9. American Goosefish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Table 10. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Figure 14. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Figure 15. American Goosefish length-frequency distributions, by cruise.

Figure 16. American Goosefish length-frequency distributions, by cruise and sex.

Figure 17. American Goosefish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013.

In spring surveys American Goosefish are captured in small numbers (typically not more than 2-3 specimens in any tow) throughout the survey range but are nearly absent from the survey area during the fall (Figure 13, Table 9). While the small number of specimens captured may indicate that the NEAMAP SNE/MA abundance indices are not representative of the entire stock, at least some information from the survey may be useful to assessments and to management. Only abundance indices from the spring surveys are shown (Table 10, Figure 14).

Specimens are captured over a fairly large size range, and no obvious size cohorts are present in NEAMAP SNE/MA data (Figure 15). Likewise, no noticeable pattern in the sizes or in the capture rates between males and females is apparent (Figure 16).

Unsurprisingly, a variety of fish species constitute the largest portion (88% by weight, 83% by number) of the diet. Longfin Squid and the Pandalid shrimp called the bristled longbeak (*Dichelopandalus leptocerus*) constitute most of the remainder (Figure 17).

American Lobster (*Homarus americanus*)

Figure 18. American Lobster biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 11. American Lobster sampling rates for each NEAMAP SNE/MA cruise.

Table 12. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 19. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 20. American Lobster length-frequency distributions, by cruise.

Figure 21. American Lobster length-frequency distributions, by cruise and sex.

Figure 22. American Lobster sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 23. American Lobster disease status (percent positive) by cruise, 2010-2013.

Figure 24. American Lobster percent of females with egg masses by cruise, 2010-2013.

Survey catches of the American Lobster are concentrated in Block Island Sound and Rhode Island Sound, though specimens have been captured as far south as the mouth of

Chesapeake Bay (Figure 18). Catch rates between spring and fall surveys are comparable (Table 11). Abundance indices for both survey seasons have followed a generally declining trend, both overall and for sex-specific indices (Table 12, Figure 19).

Relatively few individuals are captured above the legal size limit (Figure 20) however, relatively more large females are found than are males (Figure 21). This may be due to the practice of “V-notching” and releasing egg-bearing females. Except at the largest size category, sex ratios are almost exactly 50-50 (Figure 22).

For some time, a bacterial shell disease characterized by black spots, ulcers, and a thinning shell has been prevalent in Southern New England. Since 2010 NEAMAP SNE/MA has noted the presence or absence of obvious disease signs. Such signs are much more prevalent in spring than in fall (likely due to seasonal molting) but the prevalence in spring has steadily declined from about 26% in 2010 to 15% in 2013 (Figure 23). Note however that this represents only four years in a multi-decadal outbreak.

NEAMAP SNE/MA also notes the presence or absence of eggs on female specimens and the proportion of females with egg masses (‘berries’) during each cruise is presented (Figure 24). Presence or absence of a v-notch is also noted but those data are not presented here.

American Shad (*Alosa sapidissima*)

Figure 25. American Shad biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 13. American Shad sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 14. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured.

Figure 26. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured.

Figure 27. American Shad length-frequency distributions, by cruise.

Figure 28. American Shad length-frequency distributions, by cruise and sex.

Figure 29. American Shad sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 30. American Shad diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

American Shad are both well represented and well distributed in NEAMAP SNE/MA tows during spring surveys but are nearly absent from the survey during the fall (Figure 25, Table 13). Indices of abundance are calculated only for the spring and show a relatively flat profile but with a moderate uptick in 2013 (Table 14, Figure 26).

Most specimens captured by the survey measure less than 20cm and no obvious size cohorts are present in the length frequency distributions (Figure 27). There does not appear to be any sex-specific differences in the sizes of individuals from the survey (Figure 28). Likewise, the sex-ratio is even at all size classes except those small and large categories with extremely small sample sizes (Figure 29).

Over 85% of the diet, measured either by weight or number, is constituted by crustaceans, mostly copepods, amphipods, cumaceans, and mysids. Unidentifiable material comprises nearly all of the remainder of the matter in American Shad stomachs (Figure 30).

Atlantic Cod (*Gadus morhua*)

Figure 31. Atlantic Cod biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.

Table 15. Atlantic Cod sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Figure 32. Atlantic Cod length-frequency distributions, by cruise.

Figure 33. Atlantic Cod diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013.

Atlantic Cod are captured in very small numbers (0-15 total) during spring NEAMAP SNE/MA cruises (Figure 31, Table 15). These numbers are so small that calculation of abundance indices would not yield meaningful results.

Specimens over a fairly large size range have been captured, but again the numbers are so small that little relevant information can be gleaned from length frequencies (Figure 32).

About 80% (by both weight and number) of the diet of NEAMAP SNE/MA specimens is made up by a variety crustacean species with miscellaneous taxa, fishes, molluscs, and worms constituting a decreasing proportion of the remainder. Again however, the sample sizes represented are very small (Figure 33).

Of particular note however is a single tow in Region 5 (NY Harbor area) during the spring 2013 survey at which both an Atlantic cod and a Spot were captured.

Atlantic Croaker (*Micropogonias undulatus*)

Figure 34. Atlantic Croaker biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 16. Atlantic Croaker sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 17. Atlantic Croaker geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys (age-specific indices for age-2 and older calculated for fall surveys only).

Figure 35. Atlantic Croaker geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 36. Atlantic Croaker length-frequency distributions, by cruise.

Figure 37. Atlantic Croaker length-frequency distributions, by cruise and sex.

Figure 38. Atlantic Croaker age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 39. Atlantic Croaker catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 40. Atlantic Croaker sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 41. Atlantic Croaker maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 42. Atlantic Croaker maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 43. Atlantic Croaker diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Croaker catches during the spring surveys are generally limited geographically to southern NEAMAP SNE/MA Regions as this species migrates into the NEAMAP SNE/MA survey area and this pattern was observed in 2013 though isolated specimens were captured as far north as Region 3. During fall cruises it has often been observed that the 'southern mix' of species (Croaker, Spot, Weakfish, Clearnose Skate) nearly appears abruptly as the survey moves through Barnegat Light, NJ while following its fall 'north-to-south' sampling pattern and as opposed to 2012, this pattern held in fall 2013 (Figure 34).

Typically, total croaker captures in the fall are several times higher than those for spring surveys (as described above) and in previous years varied within a narrow range (46,000 – 74,000 by number, 5,100 kg – 7,600 kg by weight). In fall 2012 over 319,000 croaker were

sampled (nearly 4.5 times the previous high value) weighing nearly 22,000 kg (2.8 times the previous high value). This was followed by the capture of the largest spring season time-series catches in 2013 and the second-largest number captured during the fall 2013 survey (Table 16).

Overall abundance indices generally followed the trends in total catch levels. For spring, following a generally increasing trend over the previous four years, abundance dropped close to a time series low in 2012 but jumped to very high levels in 2013. In the fall time series, after varying without trend over a five year period, abundance rose dramatically in 2012 and then fell in 2013. Age-specific indices indicate that most of the additional specimens seen in fall 2012 and spring 2013 were age-0 and age-1 (Table 17, Figure 35).

Atlantic Croaker are sampled by NEAMAP SNE/MA over the nearly entire size range of the stock. In spring, specimens have measured between 6.5cm and 29.9cm while in fall that range expands to between 1.0cm and 45.0cm (Figure 24). Most individuals captured typically range between 12cm and 28cm.

Examination of length frequencies by sex (Figure 37) and sex ratios by size (Figure 40) reveal little evidence of sexually dimorphic growth patterns, though there is a preponderance of females in specimens measuring 32cm and larger.

Moderate numbers of croaker to age-11 have been captured though specimens aged 2 and less dominate the NEAMAP SNE/MA samples (Figures 38, 39). With the exception of age-0 specimens first captured in fall 2008 there seems to be a limited ability to follow year class cohorts as they propagate over time. It will be worth noting whether this occurs with the apparently abundant 2012 year class.

Both males and females reach the 50% maturity rate at about 17cm which corresponds to about 1 year since hatching. Similarly, both sexes reach the 95% maturity at 22-23cm, which on average is about age 2.5 (Figure 41, Figure 42).

As might be expected, large portions of the stomach contents for this species are not identifiable, or are only identifiable to a high taxonomic level. Of the identifiable items, Atlantic croaker show themselves to be generalist consumers with all major taxonomic groups contributing roughly equal percentages (within 10% by %W, within 16% by %N). Among identifiable prey items, fishes (primarily unidentifiable as to species) constituted the greatest portion of the diet by %W (26%) while crustaceans (primarily mysids and amphipods) contributed the largest share when expressed in %N (Figure 43).

Atlantic Menhaden (*Brevoortia tyrannus*)

Figure 44. Atlantic Menhaden biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 18. Atlantic Menhaden sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 19. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 45. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 46. Atlantic Menhaden length-frequency distributions, by cruise.

Figure 47. Atlantic Menhaden sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 48. Atlantic Menhaden maturity at length, by sex for all cruises pooled, 2007-2013.

Substantial differences in catch patterns for Atlantic Menhaden are observed between spring and fall surveys. In the spring catches can often be fairly consistent but are limited to the southernmost survey Regions as the species begins its inshore/northward annual migration. In the fall, interactions with the species are fairly rare but are distributed throughout the survey range (Figure 44, Table 18).

Both of these patterns make for potentially unreliable abundance indices caused by year-specific environmental factors or by random encounters with large schools. Nonetheless, abundance information for this highly important species is important for assessment and management so appropriate indices are presented (Table 19, Figure 45).

Using size cutoffs presented in ASMFC assessment documents, it is apparent that age-0 specimens typically predominate in survey fall catches and then these same year-classes are observed again in the spring as age-1 (Figure 46).

No discernable pattern is seen in sex ratios among the various size classes (Figure 47). Both sexes appear to reach the 50% maturity threshold at about 18cm, and 95% are mature at 22-24cm (Figure 48).

Bay Anchovy (*Anchoa mitchilli*)

Figure 49. Bay Anchovy biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 21. Bay Anchovy sampling rates for each NEAMAP SNE/MA cruise.

Table 18. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 50. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 51. Bay Anchovy length-frequency distributions, by cruise.

This highly important forage species is both widely distributed and very abundant in survey tows both in the spring and fall; though in the spring the specimens tend to be captured in the shallow/nearest-to-shore stations. While exceptions occur, a geographic pattern is often observed in which Bay Anchovy are typically rare or absent in survey tows conducted near the major estuarine outflows (Figure 49, Table 20).

Patterns in the abundance indices are difficult to discern for both the spring and fall surveys, though 2013 showed higher relative abundance than did 2012 for both survey seasons (Table 21, Figure 50). Interestingly, though total catch numbers for spring and fall are on approximately the same scale, the geometric mean abundance indices are about an order of magnitude greater in spring than in fall. This is likely due to moderate-but-consistent catches in the spring and highly variable catches in the fall. Geometric mean indices tend to dampen the effect of infrequent large catches. No cohorts are apparent in the length-frequencies for this “annual-crop” species (Figure 51).

Black Drum (*Pogonias cromis*)

Figure 52. Black Drum biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.

Table 22. Black Drum sampling rates for each NEAMAP cruise.

Table 23. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Figure 53. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Figure 54. Black Drum length-frequency distributions, by cruise.

Figure 55. Black Drum age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 56. Black Drum catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 57. Black Drum diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013.

This species is nearly always absent from spring surveys but can be moderately common during the fall (Figure 52, Table 22). Abundance indices for the spring, though presented, are likely not indicative of true abundance. Fall indices have varied without pattern (Table 23, Figure 53).

The rare individuals captured during spring NEAMAP SNE/MA surveys have always been large (80+cm) adult specimens while those captured in the fall are nearly all smaller (<30cm). These smaller fish have nearly all been age-0 (Figure 55, Figure 56) so the fall index may be used as representing primarily young-of-year abundance.

A variety of shelled molluscs constitute about 50% of the diet by both weight and number, while approximately another 30% is made up of several different crustacean species. Most of the remainder is classified as being unidentifiable but originally was likely one of the previous two categories (Figure 57).

Black Sea Bass (*Centropristis striata*)

Figure 58. Black Sea Bass biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 24. Black Sea Bass sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 25. Black Sea Bass geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 59. Black Sea Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and by age class (B).

Figure 60. Black Sea Bass length-frequency distributions, by cruise.

Figure 61. Black Sea Bass length-frequency distributions, by cruise and sex.

Figure 62. Black Sea Bass age-frequency distribution, by cruise.

Figure 63. Black Sea Bass catch-at-age standardized to 3,000 trawl minutes, by cruise.

Black Sea Bass sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 66. Black Sea Bass maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 67. Black Sea Bass maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 68. Black Sea Bass diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Trawl surveys are not considered to be the ideal platforms for sampling this species, given the structure-orientated nature of sea bass and the tendency for trawl surveys to avoid towing their gear over structure. It seems, however, that enough fish were collected by NEAMAP SNE/MA to extract a variety of useful information. Except for the most recent cruise, virtually all stomach samples have been analyzed.

With respect to the distribution of the catches of Black Sea Bass, collections during the spring 2013 survey, were concentrated in the deeper stations within Rhode Island Sound and Block Island Sound with lower numbers seen as far south as the mouth of Delaware Bay. During the fall survey catches again were also generally low in Regions 1-15 (NY – NC) but several tows with significant catches occurred in RIS and BIS. This pattern has been observed in several previous NEAMAP SNE/MA cruises (Figure 58). More Black Sea Bass were captured in spring 2013 than during any other spring cruise and almost 1,500 Black Sea Bass were captured in the fall 2013 survey, over three times the total number in any previous NEAMAP SNE/MA survey cruise.

Except for the time-series high values for both the spring and fall 2013 abundance indices, no consistent inter or intra-annual patterns were observed between the spring and fall survey cruises in terms of the number or biomass of Black Sea Bass caught (Table 25, Figure 59). Age-0 and age-1 Black Sea Bass are only captured in significant numbers during the fall survey and reached a time series high in 2012 followed by a decline in 2013. Age-2 and older classes all reached their highest values in fall 2013.

A broad size range (~4cm – 60cm TL among all cruises) of sea bass was collected during each of the surveys, and included both juvenile and adult specimens (Figure 60). The majority of the sea bass collected ranged between 15cm and 40cm TL, and it appeared that multiple modal size groups (likely corresponding to age-classes) were present. A 60cm sea bass (a male, age-16, weighing 3.1kg), which is believed to be the maximum size for this species, was collected during the spring 2008 cruise and a second one of the same size was collected during the fall of 2010 male, age-10, weighing 2.8kg).

Black Sea Bass are protogynous hermaphrodites, meaning that they begin life as female and, around a certain size, switch to male. This life history characteristic is evident in the trends both in length distribution by sex (Figure 61) and in sex ratio by size (Figure 65) documented by the NEAMAP SNE/MA Survey. It is important to note however that this species is incompletely metagonous, meaning that some fish are actually born as males and remain so throughout their lifetime, while some females never switch to male and as is evidenced in both of the aforementioned figures.

While specimens between ages 0 and 16 have been captured during the first 11 NEAMAP SNE/MA cruises, the large majority of sea bass taken are ages 0-4 (Figures 62, 63). No particular pattern of age distributions has been observed, except that in fall 2012 a very large number of age-1 and age-2 fish (as well as age-6) were seen. This may indicate successive years of good reproduction or it could just be a peak of availability to the survey gear due to local environmental conditions.

Due to the unusual life history of this species, the maturity schedules for males and females are markedly different with males reaching 50% maturity and about 15cm (age-1.7) and females not until 20cm (age-2.1; Figure 66, Figure 67). Both males and females reach the 95% maturity threshold at about 29cm, though this size represents age 3.3 for males and 4.1 for females.

Crustaceans comprised the largest portion (55.6% by weight, 60.8% by number) of the diet of Black Sea Bass sampled by the NEAMAP SNE/MA Survey (Figure 68). This is consistent with the findings of several past studies. Rock Crabs (*Cancer irroratus*), Hermit Crabs (superfamily *Paguroidea*), and Sand Shrimp (*Crangon septemspinosa*) were the main crustaceans consumed. Fishes accounted for 26.7% of the Sea Vass diet by weight and 23.4% by number and were represented mainly by Butterfish and Bay Anchovy among identifiable species. Longfin Inshore Squid accounted for approximately 5% of the diet by both weight and number.

Blueback Herring (*Alosa aestivalis*)

Figure 69. Blueback Herring biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 26. Blueback Herring sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 27. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 70. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 71. Blueback Herring length-frequency distributions, by cruise.

Figure 72. Blueback Herring sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 73. Blueback Herring maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 74. Blueback Herring diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Blueback Herring can be quite abundant and well distributed during spring NEAMAP SNE/MA surveys but typically are nearly absent from catches during the fall and this pattern was observed during 2013 (Figure 69, Table 27). Total numbers caught have remained within a fairly narrow range with the exception of 2011 when 71,000 specimens were captured in a single tow.

NEAMAP SNE/MA abundance indices are calculated only for the spring surveys and have shown a generally downward when expressed either in numbers or biomass (Table 27, Figure 70). As most specimens captured in the spring are typically smaller than the size cutoff established to differentiate age-1 fish from older specimens (Figure 71) the age-1 indices follow the same general pattern as that for all Blueback combined.

As is typical, at smaller sizes it is difficult to determine the sex of individual specimens by gross examination of gonads so up to about 12.5cm the sex ratio for this species is unknown. At medium sizes the ratio is close to even between males and females and then tends towards females at larger sizes, though the sample sizes in NEAMAP SNE/MA catches are small (Figure 72). Both sexes are estimated to reach 50% maturity at 15-16cm and 95% maturity at 23-25cm (Figure 73).

Nearly the entire diet for Blueback (>95% both as %W and %N), as measured by NEAMAP SNE/MA consists of copepods, with another 2-3% represented by other small crustaceans. Other taxa are nearly non-existent in the diet analyses (Figure 74).

Bluefish (*Pomatomus saltatrix*)

Figure 75. Bluefish biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 28. Bluefish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 29. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and by age (Age-0 spring and summer cohorts shown separately).

Figure 76. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A), for the youngest year class captured (B) and (using fall data only) for the spring and summer age-0 cohorts separately (C).

Figure 77. Bluefish length-frequency distributions, by cruise.

Figure 78. Bluefish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 79. Bluefish catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 80. Bluefish sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 81. Bluefish maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 82. Bluefish maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 83. Bluefish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Following the pattern typically seen for this species, Bluefish were rarely captured during the spring 2013 but was sampled throughout the NEAMAP SNE/MA survey range during the fall 2013 cruise. Unlike fall 2012 when catches tended to be largest and most consistent along the western coast of Long Island to as far south as Maryland, the largest and most consistent catches were along the coast of Virginia (Figure 75).

Bluefish are a fast-swimming, coastal pelagic species, and as such survey trawls are not deemed the most effective tool for sampling this species, especially at larger sizes. Nevertheless, appreciable amounts (number and biomass) of Bluefish were caught during fall surveys and one of the six spring surveys through 2013 (few fish were sampled during the spring 2008, 2011, 2012 and 2013 surveys – Table 28).

Fall Bluefish indices of overall abundance (both number and biomass) were relatively stable over the time series, with low survey variability (Table 29 – Figure 76). As the species does not usually reinvade the survey area until later in the spring after survey operations are completed indices as measured during spring cruises are likely not representative of true abundance. This is evidenced by the small number of survey strata in which the species appears in the spring and by the broad confidence limits for spring cruises. It is likely that spring catches are determined more by water temperatures than by abundance.

Bluefish are believed to exhibit an extended and geographically widespread spawning season, with two distinct concentrations, one in the spring in the South Atlantic Bight and one during summer in the Middle Atlantic Bight (Kendall and Walford, 1979). This pattern results in two distinct YOY cohorts. Examination of NEAMAP SNE/MA length frequency plots (Figure 77) shows that these two cohorts reveal themselves in NEAMAP SNE/MA data and cohort strength can likely be estimated separately. Therefore, using fall survey data only, YOY indices are calculated both for all YOY fish pooled and for each cohort separately (Table 29, Figure 76). Interestingly, the indices for each cohort appear to have followed nearly opposing trends over the time series. The spring cohort followed a mild but consistent decline between 2007 and 2010 before rising substantially in both 2011 and 2012. Summer cohort YOY increased consistently between 2007 and 2009 before following an equally consistent decline in 2010, 2011, and 2012. In 2013 the spring cohort was at a moderately low value but the summer cohort rose after the previous decline.

Bluefish collected during the fall surveys generally ranged from 7cm to 75cm FL (Figure 77). The sizes of the majority of the specimens sampled during each of these surveys indicate that YOY and age-1 fish were the dominant age-classes sampled. This is probably due both to the structure of the population (i.e., more younger fish available) and the ability for larger, faster Bluefish to avoid the trawl. Bluefish collected during spring cruises were almost exclusively those from the previous summer cohort, though a small number of larger specimens are normally captured.

The vast majority of fall NEAMAP SNE/MA captures are age-0 and those in the spring are age-1, though individuals to age-7 have been seen. As the NEAMAP SNE/MA samples are dominated by age-0 and age-1 fish, it is not possible to evaluate the survey's ability to follow year classes through time (Figure 79).

A plot of sex ratio by size (Figure 80) showed that Bluefish do not exhibit any apparent sexually dimorphic trends, and ratios were approximately 1:1 (male to female) for most length groups. Similarly, the maturity schedules for males and females are nearly identical with both sexes reaching the 50% maturity rate at about 30cm (age 1.6-1.8 based on a 1 January birthdate) and 95% maturity at 44-45cm (about age-3; Figure 81, Figure 82).

As expected, the diet of Bluefish collected by NEAMAP SNE/MA was overwhelmingly dominated by fishes, 96.8% by %W and 93.1% by %N (Figure 83). Bay Anchovy accounted for roughly half of the Bluefish diet by both weight and by number. Butterfish, Striped Anchovy and Sand Lances also constituted significant amounts of the identifiable teleost prey types. The morphology and behavior of this species are well suited for a piscivorous lifestyle. Besides fishes, Longfin Squid were the only other prey type accounting for any appreciable portion of Bluefish diets.

Brown Shrimp (*Farfantepenaeus aztecus*)

Figure 84. Brown Shrimp biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 30. Brown Shrimp sampling rates for each NEAMAP SNE/MA cruise.

Table 31. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 85. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 86. Brown Shrimp length-frequency distributions, by cruise.

Brown Shrimp are typically not highly abundant in NEAMAP SNE/MA tows, being limited to the southernmost survey Region in the spring (if they are present at all) and near the Virginia and North Carolina coasts in the fall (Figure 84, Table 30). Abundance indices are likely to be related more to local environmental conditions than to overall stock abundance (Table 31, Figure 85). When present in the survey a narrow length frequency band is usually seen, with a mode at 13-14cm total length.

Butterfish (*Peprilis triacantus*)

Figure 87. Butterfish biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 32. Butterfish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 33. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and by age class.

Figure 88. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and by age class (B).

Figure 89. Butterfish length-frequency distributions, by cruise.

Figure 90. Butterfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 91. Butterfish catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 92. Butterfish sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 93. Butterfish maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 94. Butterfish maturity at age, by sex for all cruises pooled, 2007-2013.

Butterfish have consistently been one of the most abundant species in collections made by the NEAMAP SNE/MA Trawl Survey and are ubiquitous throughout the survey's range (Figure 87). In the spring of 2013 the very largest catches were in several consecutive tows near Montauk, NY with smaller but consistent numbers in all Regions. Fall abundances were highest in the Sounds as well as in Regions 12-15 (VA and NC) and lower but consistent at most sites in between. The spring 2013 survey saw the smallest total number of butterfish captured compared to any other NEAMAP SNE/MA survey but the fall survey captured the second largest number in the seven years of the survey (Table 32). Given the relatively consistent and abundant catches of this species by the NEAMAP SNE/MA gear, it is likely that butterfish were well sampled by this survey.

Spring and fall indices have exhibited nearly opposing trends in overall abundance since the survey began and this continued in 2013. Spring abundance generally declined between 2008 and 2010 before exhibiting a nearly straight-line increase in subsequent years followed by a steep dropoff in 2013. Conversely, fall abundance exhibited a steady upward trend over the first four survey years before falling substantially in 2011 and 2012, both in numbers and biomass but increasing to moderate levels in 2013 (Table 33 - Figure 88). Estimates of index variability are quite small. As catches for this species tend to be dominated by younger fish, age-specific abundance patterns tend to follow those for the all ages combined. A notable exception however is a sharp decline in age-0 fish during the spring 2012 when overall abundance reached a time series high but age-0 abundance was the second-lowest in the time series. NEAMAP SNE/MA abundance indices for this species are likely highly influenced by environmental conditions (mainly temperature) before and during the survey.

Examination of cruise-by-cruise length frequencies (Figure 89) reveals that in most years distinct year-classes may be evident. An interesting but unexplained pattern is observable in the fall survey length distribution plots in that a peak in abundance seems to alternate back and forth each year between 6cm-8cm and 9cm-11cm and this pattern continued in 2013. Whether this represents differential growth, age-cohorts, or is just an interesting anomaly remains to be determined.

Generally, there is not an evident pattern of age-cohorts moving through the stock as measured by NEAMAP SNE/MA. That is, a large recruitment of age-0 butterfish in one year is not necessarily seen the following year; conversely, a large cohort of age-1 specimens may be seen which was not in evidence during the previous year (Figure 90, Figure 91).

No apparent trends were evident in the butterfish sex ratio by size (Figure 92); however it was not possible to accurately classify most of the fish smaller than 10cm FL due to the small size of the gonads. Similarly, 50% of both males and females attain sexual maturity at

10-11cm FL which corresponds to about age 1.5 based on a 1 January birthdate. Both sexes reach the 95% maturity rate at about 16cm or 3.3 years.

Diet samples are not taken for this species as previous experience reveals that little identifiable prey is observable in preserved stomachs.

Clearnose Skate (*Raja eglanteria*)

Figure 95. Clearnose Skate biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 34. Clearnose Skate sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 35. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 96. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 97. Clearnose Skate width-frequency distributions, by cruise.

Figure 98. Clearnose Skate width-frequency distributions, by cruise and sex.

Figure 99. Clearnose Skate sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 100. Clearnose Skate maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 101. Clearnose Skate diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Though this species is managed as a part of the skate complex by the New England Fishery Management Council and is sometimes present even in the northernmost survey stations, this species is usually most abundant from New Jersey and southward. In the spring Clearnose Skate are captured in nearly every tow in Regions 8-15 and the same is true during fall surveys for regions 1-15 (Figure 95). In both spring and fall during 2013 the highest abundances were observed off the coast of Virginia. The total number of specimens captured during NEAMAP SNE/MA surveys is remarkably consistent within season, ranging between 1,700 and 3,200 in the spring and 875 and 1,500 in the fall (Table 34).

Likewise, abundance indices for both seasons have varied without trend within a fairly narrow range; though after a sharp increase in the fall 2012 index abundance fell in 2013 to previous levels (Table 35, Figure 96).

In most survey years no evidence is observed of size cohorts within the portion of the stock captured by the NEAMAP SNE/MA survey (Figure 97). Specimens typically range between 20-50cm disk width, with a peak at about 42cm during both seasonal surveys. Males are typically somewhat more abundant in survey tows than are females and at about 40cm the mode for males is somewhat smaller than that for females at about 45cm (Figure 98). These patterns are also seen in size-specific sex ratio data (Figure 99). Similarly, males appear to reach sexual maturity at a slight smaller size, with 50% being mature at about 35cm (95% at 41cm) whereas 50% of females are mature at 37cm (and 95% at 44cm; Figure 100).

The diets of Clearnose Skate are comprised of a variety of crustaceans, fishes, and molluscs in decreasing order (53.6%, 29.1%, 15.9% by %W, respectively; 63.4%, 18.3%, 14.7% by %N). The portion of the diets comprised of crustaceans is dominated by a selection of small crabs and shrimp while among fishes appreciable amounts of Atlantic Croaker, Spot, Sand Lances, Butterfish, and several other species are present as well. Clams and Longfin Squid are the most abundant molluscs in the diet of this species (Figure 101).

Horseshoe Crab (*Limulus polyphemus*)

Figure 102. Horseshoe crab biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 36. Horseshoe crab sampling rates for each NEAMAP SNE/MA cruise.

Table 37. Horseshoe crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 103. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

Figure 104. Horseshoe crab width-frequency distributions, by cruise.

Figure 105. Horseshoe crab width-frequency distributions, by cruise and sex.

Figure 106. Horseshoe Crab sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 107. Horseshoe Crab maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 108. Horseshoe Crab virginity at length, by sex for all cruises pooled, 2007-2013.

Due to the multiple uses to which this species is put, and to the apparent relative efficiency with which the NEAMAP SNE/MA sampling gear captures horseshoe crabs, it is apparent that NEAMAP SNE/MA can contribute significantly to the assessment. Indeed with the recent loss of funding for the dedicated Horseshoe Crab survey conducted by Virginia Tech,

the NEAMAP SNE/MA survey will likely become the main source of fishery independent data for this species.

Following its generally accepted distribution and migration patterns, catches are typically highest near-and-to-the-south of Delaware Bay but specimens are captured throughout the survey range even occasionally in RIS and BIS (Figure 102). Within any given year, total catch rates in the spring surveys usually exceed those in the fall, though this is not always the case. In 2013, the second smallest number of Horseshoe Crabs was captured during the spring survey (larger only than 2012) and the smallest number in the time series was captured in fall 2013 (Table 36).

Abundance indices followed the pattern of overall catches with a generally declining (though variable) trend for spring and fall abundances generally increasing through 2012 but showing a steep decline in 2013 (Table 37, Figure 103). Due to the differential uses to which animals from each sex are put, sex-specific abundances are presented, though the patterns for each sex follow together almost perfectly, but with females showing slightly higher numbers (and weights), especially during the spring.

A wide size range of specimens was captured in each NEAMAP SNE/MA seasonal survey, ranging between 8cm and 45cm, with most measuring between 12cm and 32cm (Figure 104). During many surveys, a cohort (perhaps a year class) of specimens less than 16cm is apparent (more often in spring than in fall). If it can be verified that this cohort corresponds to a particular age class then year class specific estimates of abundance can be provided in future reports.

Sex-specific length-frequency histograms (Figure 105) and sex-ratios by size class (Figure 106) reveal a pattern of sexually dimorphic growth, with the largest specimens (greater than about 25cm) nearly always being females.

As male Horseshoe Crabs are typically smaller than females, it is not surprising that there is a marked difference in sizes at maturity between the sexes. Fifty percent of males are sexually mature at about 18cm CW and 95% are mature at about 20cm. Females however don't reach these maturity rates until 22cm and 27cm respectively (Figure 107).

Similarly, as described by Walls et al. (2002) by examining the presence or absence of the 'atrophied nonmoveable chela' (males) or the presence or absence of 'mating scars' and the the carapace (females) it is possible to determine whether an individual crab has ever mated. NEAMAP SNE/MA records these data. Fifty percent of males are classified as non-virgin at about 19.5cm with 95% having mated at about 24cm. For females, these figures are 26cm and 32cm, respectively (Figure 108).

Kingfish (*Menticirrhus* spp.)

Figure 109. Kingfish biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 38. Kingfish sampling rates for each NEAMAP SNE/MA cruise.

Table 39. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Figure 110. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

Figure 111. Kingfish length-frequency distributions, by cruise.

Figure 112. Kingfish sex ratio, by length group, for all cruises pooled, 2012-2013.

Figure 113. Kingfish maturity at length, by sex for all cruises pooled, 2012-2013.

Three closely related species of Kingfish occur within the NEAMAP SNE/MA sampling area. These are the Northern Kingfish (*Menticirrhus saxatilis*), the Southern Kingfish (*Menticirrhus americanus*), and the Gulf Kingfish (*Menticirrhus littoralis*). As there are no consistently reliable field identification characters, these species are generally lumped together both in fisheries dependent and fisheries independent data. While it would be preferable to not do so, NEAMAP SNE/MA follows this precedent and records all specimens simply as Kingfish.

Kingfish are present throughout the survey range but are most abundant from mid-New Jersey and southward, especially in Virginia and North Carolina waters. In Regions 6-15 Kingfish are typically present in nearly every tow and this pattern was present in 2013 in both the spring and fall (Figure 109). Kingfish are typically (though not always) even more abundant during fall surveys than in the spring (Table 38).

As this species was reclassified as a 'Priority A' species beginning only in 2012, and as processing of the ageing samples has been delayed so that personnel can concentrate their time on other species, age-length keys were developed using data from the ChesMMAAP survey which is also prosecuted by the VIMS Multispecies Research Group. These keys will likely have to be updated when NEAMAP SNE/MA samples are processed, and therefore the age-specific indices will change in future reports.

Though, as previously stated, Kingfish are abundant during both the spring and fall survey seasons, abundance indices for the two seasons follow somewhat different patterns. In the spring, after an initial high value in 2008, three consecutive years of lower abundance followed until a time-series high was reached in 2012. In 2013 overall spring abundance decreased somewhat but was still the second highest value in the series. Fall abundance

indices seem to generally vary without trend though the 2013 values were at or near time-series lows for the overall index and for each age class (Table 39, Figure 110).

Kingfish between about 8cm and 40cm TL are captured by the survey, with most individuals measuring between about 12cm and 30cm. Length frequency histograms reveal that during spring surveys generally at least two size cohorts are present, with the smallest cohort likely representing fish which were spawned during the previous calendar year. In most years, it is less obvious whether size cohorts (presumably age classes) are present in specimens captured during fall surveys (Figure 111).

Among those fish for which sex can be readily determined, males are predominate in the mid sizes (17-22cm) and females tend to be more abundant in size groups of 22cm and greater (Figure 112). However, sexual maturity rates are nearly identical with both sexes being 50% sexually mature at 20-21cm and 95% mature at 30cm (Figure 113).

Little Skate (*Leucoraja erinacea*)

Figure 114. Little Skate biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 40. Little Skate sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 41. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 115. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 116. Little Skate width-frequency distributions, by cruise.

Figure 117. Little Skate width-frequency distributions, by cruise and sex.

Figure 118. Little Skate sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 119. Little Skate maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 120. Little Skate diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Little Skate are most abundant in tows conducted in the northern portion of the survey range but are present in more southern locations, especially during spring. Indeed in spring 2013 specimens were captured at two locations in North Carolina (Figure 114). Capture

rates are similar for both spring and fall surveys though they are typically slightly more abundant in spring than fall, both in numbers and biomass (Table 40).

For the spring surveys, abundance measured as either numbers or biomass has been nearly flat for four years running after declining from initial high values in 2008 and 2009. In the fall, after an initial moderate value in 2007, abundance increased through 2009, followed a three-year decline to a time-series low in 2013 but recovered to a moderately high level in 2013 (Table 41, Figure 115).

Length-frequencies are remarkably similar in each year and between seasons with specimens generally ranging in size from 16-30cm DW (Figure 116). Similarly, sex-specific length frequency histograms exhibit no particular differences in growth between males and females (Figure 117). Up to about 45cm size-specific sex ratio vary a bit but hover right around 1:1. The largest specimens above 47cm are all males, though the number of specimens examined is very small.

From NEAMAP SNE/MA samples, 50% of both males and females reach sexual maturity at 22-23cm, though the sizes at 95% maturity differ a bit more (M: 25cm, F: 28.5cm). The shape of these logistic maturity regressions may be affected somewhat however by the fact that very small specimens of this species and Winter Skate can be hard to distinguish and NEAMAP SNE/MA records these non-identifiable individuals using a separate species identifier (Figure 119).

Given the relatively small body size and bottom-hugging habit of this species it is not surprising that the diet is dominated by small crustaceans (58% by %W, 74% by %N), predominantly amphipods, cumaceans, and small shrimps and crabs. However, molluscs (mainly small clams), worms, and fishes also constitute significant portions of the overall food habits (Figure 120).

Longfin Inshore Squid (*Doryteuthis pealeii*)

Figure 121. Longfin Inshore Squid biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 42. Longfin Inshore Squid sampling rates for each NEAMAP SNE/MA cruise.

Table 43. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 122. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 123. Longfin Inshore Squid length-frequency distributions, by cruise.

Figure 124. Longfin Inshore Squid length-frequency distributions, by cruise and sex, 2013 only.

Figure 125. Longfin Inshore Squid maturity classification by season and sex, 2013 only.

In spring 2013, Longfin Inshore Squid (commonly called *Loligo* though the scientific name was recently changed) were collected nearly throughout the NEAMAP SNE/MA survey area, though in considerably smaller numbers than in previous spring surveys. During the fall, consistent very large catches were seen in the Sounds and near Montauk, NY with smaller numbers throughout the rest of the survey area (Figure 121).

The abundances of *Loligo* squid encountered during the fall cruises have consistently been greater than those observed during spring (Table 42). When comparing within seasons, during the spring there was a generally decreasing level of total catch between 2008 and 2011 but a time series high (nearly 2.5 times greater than the previous high catch) in 2012 followed by a decline in 2013 to the smallest number in the time series; fall cruises during 2010, 2011, and 2012 had substantially lower levels of catch than the first three survey years but increased to moderate levels in 2013.

Abundance indices for *Loligo* squid followed similar patterns as overall catches both in terms of number and biomass (Table 43, Figure 122). Indices for the spring followed a declining trend between 2008 and 2011 but reached a high in 2012 (twice the previous high value) then fell to a time-series low in 2013 (note that the very high value in 2012 corresponded with very high fishery abundance later that summer and the low index in spring 2013 likewise foreshadowed low fishery abundance observed by the commercial sector during summer 2013). Fall values vary year by year with perhaps a decreasing trend between 2009 and 2012 but with a marked increase in 2013.

With respect to the sizes of specimens collected, squid caught on the spring cruises ranged from 1cm mantle length (ML) to 29cm ML (Figure 123). Most of the *Loligo* collected in fall surveys are less than 15cm while many larger specimens tend to be captured in the spring though this pattern was broken in fall 2013 when some of the largest specimens seen by the survey were quite abundant. Examination of the length frequencies reveals apparent cohorts within our catches but no attempt has yet been made to develop a distinct YOY index for NEAMAP SNE/MA. This may be possible with additional research. NEAMAP SNE/MA began recording sex (and measuring certain internal organs to determine maturity) on a subsample of specimens in 2013. Sex-specific length-frequencies show that at least for the fall 2013 survey male Longfin Squid are more numerous in survey tows than are females (Figure 124).

As previously stated, in 2013 NEAMAP SNE/MA began recording measurements on individual specimens which allow for assignment (during post processing of data) of those specimens to one of four maturity stages. These data reveal that during spring 2013 nearly all female Longfin Squid and a large majority of males were sexually mature. In the fall,

again most females were mature but the large majority of male squid were classified as maturing (Figure 125).

Sandbar Shark (*Carcharhinus plumbeus*)

Though never captured in large numbers by NEAMAP SNE/MA (0-7 in spring surveys between 2008 and 2013; 5-81 during fall surveys beginning in 2007; Table 44) this species is thought to be an important predator in the Mid Atlantic Bight and worthy of species-specific analyses. As noted, very few specimens were captured during any NEAMAP SNE/MA spring surveys and this was true in 2013 (1 individual); and while in numbers relatively few Sandbars are captured during fall surveys (28 in 2013) the total biomass represented by the species (108kg in 2013) would rank among the top 15 'Priority A' species. Most of this biomass was accounted for by a single specimen (the southernmost station) in 2013 but the species was also captured at several stations just south of the mouth of Chesapeake Bay (Figure 126).

Validation of survey abundance indices for this species has not yet been attempted (the VIMS Multispecies Research Group also conducts the VIMS shark longline survey so the data to support such validation may exist within the group) but are shown here regardless. The species generally increased in abundance between 2007 and 2012 but declined to middle-level figures in 2013 (Table 45, Figure 127).

Most specimens captured by the survey ranged between 40-80cm PCL and no length cohorts were observed. In fall 2013 the largest specimen yet captured (132cm, 52kg) was captured in southern North Carolina (Figure 128). No pattern of sexual dimorphism was observed either in sex-specific length-frequencies (Figure 129) or in size-specific sex ratio data (except in size classes with extremely low sample sizes; Figure 130).

Scup (*Stenotomus chrysops*)

Figure 131. Scup biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 46. Scup sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 47. Scup geometric mean indices of abundance, for all specimens captured by number and biomass and by age-class for spring and fall NEAMAP surveys.

Figure 132. Scup geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

Figure 133. Scup length-frequency distributions, by cruise

Figure 134. Scup age-frequency distribution, by cruise.

Figure 135. Scup catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 136. Scup sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 137. Scup maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 138. Scup maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 139. Scup diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Scup were collected in consistently small-to-moderate numbers from throughout the survey area during the spring 2013 cruise and in high abundance in RIS and BIS. During the fall 2013 survey the smallest total number of Scup for any fall survey to date was observed. Four tows with moderately high numbers occurred in RIS and BIS but elsewhere Scup were seen either in small numbers or were absent (Figure 89, Table46).

The overall abundance indices for Scup (both spring and fall) showed large declines between the first two survey years (2007-2008 for fall, 2008-2009 for spring) followed by a leveling off or small decline through 2011. In 2012 the spring and fall indices followed divergent paths with the spring index being the second highest for the series and that for fall remaining at the low level seen in the previous 3-4 years. The spring index fell again in 2013 to approximately the same levels observed in 2009-2011 and the fall index fell to a time-series low value (Table 47, Figure 132). As is true for several species, NEAMAP SNE/MA Scup abundance indices are likely to be highly influenced by availability of this species in the sampling area. Scup move inshore to spawn during the spring, and their migration is likely triggered by temperature. In varying portions of the survey area in each year, water temperatures remained cold (see Figure 3), throughout the time of the survey and may have affected catch rates for this species. Age-specific indices generally follow the patterns exhibited for overall abundance though the decline in fall indices is not as steep for older fish (age-2+) as for younger fish.

Scup sampled during the fall cruises ranged from 3cm to 41cm FL (Figure 133– difficult to see range due to scale of y-axis). As noted above (and below), a majority of fish collected during the fall surveys were YOY individuals. The age-length key for fall Scup assigns nearly all specimens less than 6cm FL and a decreasing proportion up to 20cm FL to age-0. Spring data are similar, with a slight shift to the left. Generally, a broader size range and somewhat more even distribution of specimens is seen in spring surveys and a significant number of larger individuals ranging up to 43cm FL were captured. Age frequency plots (Figures 134, 135) confirm this pattern.

No particular trends were evident in the sex ratio of Scup by size class (Figure 136). The largest specimens collected were mainly female, but sample sizes of the bigger fish are relatively small, so it would be necessary to collect additional information prior to drawing any conclusions.

Males and females appear to have very similar maturity schedules reaching the 50% and 95% maturity thresholds at about 15cm and 21cm respectively (Figure 137). These sizes correspond to ages 2 and 3.4 (based on a 1 January birthdate; Figure 138).

Crustaceans accounted for about 53% of the Scup diet composition by weight and 59% by number (Figure 139). Amphipods and small, shrimp-like animals were the dominant prey types within this category. Of the remaining identifiable prey categories, worms accounted for roughly 14% by %W and 12% by %N of the diet, with fishes and molluscs at about 8% or less.

Silver Hake (*Merluccius bilinearis*)

Figure 140. Silver Hake biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 48. Silver Hake sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 49. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured.

Figure 141. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 142. Silver Hake length-frequency distributions, by cruise

Figure 143. Silver Hake sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 144. Silver Hake maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 145. Silver Hake diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Total abundance of Silver Hake during NEAMAP SNE/MA cruises varies widely both between seasons and among years within seasons. Total numbers range from 4,843 (2013) to 35,837 (2012) for spring cruises and 328 (2012) to 3,125 (2008) during the fall. Catches during 2013 were low during both cruises though in the spring this species was captured in every survey

Region. In fall 2013 catches were smaller and more sparsely spaced but ranged from RIS down nearly to the mouth of Chesapeake Bay (Figure 140, Table 48).

Despite the variability in total catch rates, spring abundance indices varied within a fairly narrow range, with the exception of 2012 when the index peaked at a value 2-3 times that of previous (and one subsequent) years. Fall survey indices are more variable though it is noted that the 2011 figure was the highest of the time series and may represent the same specimens subsequently observed in spring 2012. Otoliths for this species have not yet been analyzed so age-specific abundances were calculated based on single-value length cutoffs and therefor may not be as reliable as those for other species (Table 49, Figure 141).

Length-frequency histograms reveal distinct length cohorts which presumably represent age-classes. Those specimens presumed to be age-0 in the fall are 17cm FL and smaller while during the same season those larger than 17cm are assumed to represent age-1 fish. During the spring, the age-0s from the previous fall have been promoted to age-1 and lie between 6-20cm. Those larger than 20cm are assigned to age-2+ (Figure 142).

Up to about 15cm large numbers of the specimens examined to determine sex cannot be assigned based on gross examination. Between 15cm and 25cm there is approximately a 1:1 sex ratio but above that size most specimens were identified as being females (Figure 143). Sexual maturity rates are similar for males and females with 50% of both sexes being mature at 18-19cm and 95% being mature at 25-27cm.

As has been observed in other studies, the diets of SNE silver hake are dominated by crustaceans (68.3% by %W, 84.5% by %N) amphipods, mysids and various small shrimp species being predominate. Fishes make up another 29.3% by %W and 13.3% by %N. Other taxa are represented in very small amounts (Figure 145).

Smooth Butterfly Ray (*Gymnura micrura*)

Figure 146. Smooth Butterfly Ray biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.

Table 50. Smooth Butterfly Ray sampling rates for each NEAMAP cruise.

Table 51. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 147. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Figure 148. Smooth Butterfly Ray length-frequency distributions, by cruise.

Figure 149. Smooth Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2013.

This species is not currently under management and is not usually sought by recreational or commercial fisheries. However, in terms of biomass (captured specimens have ranged from 01.kg to 127kg) it consistently ranks high in the list of species captured in the survey and should be considered as an important member of the ecosystem. A VIMS graduate student within the Multispecies Research Group has taken on both this species and the congeneric Spiny Butterfly Ray to better define the biology and the ecological role of these species.

Smooth Butterfly Rays are normally captured only in the Virginia and North Carolina portions of the NEAMAP SNE/MA survey and this was the case in 2013 (Figure 146). Very few (0-16) individuals were captured during spring surveys but up to almost 300 specimens have been sampled in the fall (total weight 557kg; Table 50).

Due to the near absence of this species during spring surveys, abundance indices are calculated only for the fall season. With the exception of a single above average year in 2008 abundance has bounced around a fairly steady mean value (Table 51, Figure 147).

Specimens between 25cm DW and almost 2m DW have been captured in survey tows. Examination of length frequency plots reveals what appears to be a fairly consistent cohort below a disk width of about 75cm (Figure 148). Whether this group represent a particular age class will have to be determined from samples now being taken. Between 60% to 90% of specimens smaller than 50cm have been identified as males while nearly 100% of specimens larger than 55cm are females (Figure 149).

Smooth Dogfish (*Mustelus canis*)

Figure 150. Smooth Dogfish biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 52. Smooth Dogfish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 53. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and for the youngest year class captured (fall only).

Figure 151. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured (A) and for the youngest year class captured (B).

Figure 152. Smooth Dogfish length-frequency distributions, by cruise.

Figure 153. Smooth Dogfish length-frequency distributions, by cruise and sex.

Figure 154. Smooth Dogfish sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 155. Smooth Dogfish maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 156. Smooth Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Figure 157. Smooth Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.

This species is normally captured consistently throughout the survey range with local concentrations often occurring at the mouths of the major estuaries. This pattern held for both surveys during 2013, with the most consistent high catch rates occurring near the mouth of Delaware Bay during both seasons (Figure 150). The total numbers and biomass captured during each season/survey varies within a fairly narrow range, though it may be declining. Spring 2012 saw the smallest number (and biomass) of Smooth Dogfish captured during any single NEAMAP SNE/MA survey but the quantity recovered in 2013 to approximately the same levels as seen in 2010 and 2011. During fall surveys the largest numbers of specimens were captured in 2007 and 2009 with all other years falling within a narrow range (Table 52).

These patterns in overall catch are matched by the abundance index calculations with the spring survey following a nearly straight-line decline (with a small rise in 2013), and the fall survey declining in each of the last four years (Table 53, Figure 151).

Smooth Dogfish between 25cm PCL and almost 120cm PCL have been measured by the survey. Distinct size cohorts are evident in the fall catches with the cohort falling below the 47cm cutoff corresponding to age-0 fish as described by Conrath et al. (2002).

In the spring, NEAMAP SNE/MA catches are predominantly (~60%) male for specimens up to about 85cm with a preponderance of females at larger sizes. In the fall, the sex ratio is about 50-50 up to 80cm, with females again primarily abundant in larger size classes (Figures 153, 154). Consistent with those findings, it appears that males mature at slightly smaller sizes than do females with 50% of males reaching sexual maturity at about 64cm while females reach that level at 73cm. Ninety-five percent maturity rates are reached at 76cm and 85cm for males and females respectively (Figure 155).

Based on analysis of over 2,316 individual stomachs (representing 1,033 'clusters' of samples), the diet of Smooth Dogfish was dominated by crustaceans (72% by %W, 64% by %N), followed by molluscs, fish, and worms. Nearly all of the identifiable crustaceans represented several different species of crabs. This diet is in sharp contrast to this species' close namesake (though taxonomically somewhat distantly related) species, Spiny Dogfish, which consists primarily (~50% by %W) of several species of fish (Figure 156).

NEAMAP SNE/MA records several additional data elements on the reproductive status of female Smooth Dogfish. Specifically, a subsample of specimens (the same subsample examined for individual length, weight, sex, maturity, age, diet) is dissected and the numbers and stages of embryos/pups are logged and any pups present are measured (PCL). Between 0 and 20 embryos were observed in individual specimens. For all spring surveys combined, about 30% of these fish contained no embryos while in fall that number is about 14%. For both seasons, among those specimens containing embryos most specimens carried between 8 and 12 pups (Figure 157-A). Again among those individuals which contained embryos small percentages (6.7% in spring, 2.2% in fall) were at the egg stage and the remainder were pups (Figure 157-B). In terms of length, smaller pups were observed during fall surveys with a peak at about 125mm but these pups had approximately doubled in length by spring when the peak modal size was about 250mm (Figure 157C).

Spanish Mackerel (*Scomberomorus maculatus*)

Figure 158. Spanish mackerel biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 54. Spanish mackerel sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 55. Spanish mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 159. Spanish mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 160. Spanish mackerel length-frequency distributions, by cruise.

Figure 161. Spanish mackerel diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2012.

Due to the fast swimming pelagic nature of Spanish Mackerel, the NEAMAP SNE/MA survey is not considered to be an efficient platform for gathering high quality data on this species. However, this species is classified as a Priority A species and therefore what data exists will be reported.

No Spanish Mackerel have ever been captured during spring NEAMAP SNE/MA surveys. Total capture rates during fall surveys has ranged between 1 (in 2013) and 161 (in 2007; Table 54) but specimens are rarely captured outside of Regions 14-15 (Figure 158).

While sample sizes are extremely small and the quality of data is undetermined, abundance indices for fall surveys reveal high variability with perhaps a downwards trend (Table 55, Figure 159).

Spanish Mackerel specimens captured by the survey have ranged between 8-44cm FL. During years in which higher numbers of individuals were encountered a cohort between about 20-28cm appears to consistently be present (Figure 160). This cohort corresponds to age-0 fish (Gaichas 1997).

Though sample sizes are very small, food habits analyses for this species coincide with other studies which report that this species is highly piscivorous. Among the major taxa, only fishes have been found in the stomachs sampled by NEAMAP SNE/MA. Bay Anchovy constitute about two-thirds of the diet by either %W or %N with Silver Anchovy, Striped Anchovy, unidentified Anchovies accounting for the vast majority of the diet (Figure 161).

Spiny Butterfly Ray (*Gymnura altavela*)

Like the very similar congeneric Smooth Butterfly Ray this species is not currently subjected to any management measures and is not sought by either the commercial or recreational sectors. Again with its cousin however, even though survey catch in numbers is relatively small the total biomass represented is often within the top tier within the survey. Therefore data results will be reported.

Spiny Butterfly Rays are rarely captured in spring NEAMAP SNE/MA surveys. Fall catch rates have varied between 33 and 133 specimens, or approximately 113-1,360kg. Specimens are typically captured in Regions off the coast of Virginia and North Carolina though individuals have been caught north of those areas (Figure 162).

Fall abundance indices have so far varied in two-to-three year cycles, declining between 2007 and 2008, then rising until 2011, and subsequently falling in 2012 and 2013. Depending upon the size of the individuals captured in any given year the indices by number vs. weight can differ substantially, though trends between the two measures are very similar (Table 51, Figure 163).

Spiny Butterfly Rays ranging between 25cm and 235cm DW have been observed in the survey. Most specimens have measured between 40-140cm. Though capture rates were likely not sufficient to make a firm determination, there appears to be a cohort with a maximum size of about 100cm which may correspond to an age-class (Figure 164).

Though the proportion of males to females within size groups varied somewhat (likely due to small sample sizes), overall there does not appear to be any trend in sex ratios over the range of sizes observed by the survey (Figure 165).

Spiny Dogfish (*Squalus acanthias*)

Figure 166. Spiny Dogfish biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 58. Spiny Dogfish sampling rates and preserved specimen workup status for each NEAMAP SNE/MA cruise.

Table 59. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 167. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 168. Spiny Dogfish length-frequency distributions, by cruise.

Figure 169. Spiny Dogfish length-frequency distributions, by cruise and sex.

Figure 170. Spiny Dogfish sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 171. Spiny Dogfish maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 172. Spiny Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Figure 173. Spiny Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.

The seasonality of the NEAMAP SNE/MA collections of Spiny Dogfish is consistent with the accepted migratory patterns of this species. These fish congregate in Mid-Atlantic waters in winter and early spring, and then migrate north in the late spring and summer. By fall, the southern extent of this species' range only overlaps with the most northeastern reaches of the NEAMAP SNE/MA sampling area (i.e., RIS and BIS).

The catch distribution of Spiny Dogfish from the 2013 NEAMAP SNE/MA survey cruises reflected this migratory pattern (Figure 119). In 2013 this species was nearly absent from collections during the fall survey except for a few stations in RIS and along Long Island. Spiny Dogfish were consistently collected through most of the NEAMAP SNE/MA survey area (RIS to Virginia) during the spring 2013 cruise. As in several previous years large concentrations were observed near the mouths of major estuaries (Raritan Bay, Delaware Bay and Chesapeake Bay).

Catches of Spiny Dogfish by the NEAMAP SNE/MA Trawl Survey varied seasonally, and within seasons annual variability is high; spring collections consistently exceeded fall

catches (Table 58). Approximately 1,300 specimens, with a gross weight between 3,300 kg and 3,600 kg, were sampled during the spring cruises in 2008 and 2009 but only 249 and 180 individuals (804 kg, 548 kg) were captured in spring 2010 and 2011 respectively. During the fall of 2012 the number taken recovered to moderate levels (762 specimens weighing 2,167kg) but rose again to time-series high values in 2013 (1,838 specimens weighing 4,228kg). Catches on the second and third fall surveys exceeded those on the first by an order of magnitude in terms of number and by two orders of magnitude with respect to weight but were almost nonexistent (4 and 40 specimens respectively) in fall 2010, 2011, and 2012 but rose again to 477 specimens (993kg) in 2013.

Likewise, the abundance indices for Spiny Dogfish, both in terms of number and biomass, showed a slight increase between the 2008 and 2009 spring surveys before falling considerably in 2010 and 2011 but recovering to a moderate level in 2012 and rising again in 2013 (Table 59, Figure 167). For the fall surveys, abundance with respect to both numbers and biomass generally increased between 2007 and 2009 and, similarly to the spring survey, fell dramatically in 2010 and was flat in 2011 and 2012 before recovering slightly in 2013. These fluctuations, especially as measured by the fall survey, are as likely to be due to variability in annual migration patterns and availability to the survey as to real changes in stock size and must be used in consideration with data from other surveys.

Based on the length-frequency distributions, it appeared that both juvenile and adult dogfish were collected on most NEAMAP SNE/MA surveys (Figure 168). Fish sampled on the first fall survey ranged from 63cm to 88cm pre-caudal length (PCL). Those collected during the fall 2008 cruise were from 21cm to 78cm PCL, but two very distinct modal size groups were present (21cm to 36cm PCL and 52cm to 78cm PCL). These modal size groups represented the juvenile and adult fish. The length distribution documented during the fall 2009 cruise was similar, however the size range of the smaller modal group was slightly larger (i.e., 29cm PCL to 40cm PCL) than that observed in 2008. Length data for fall 2010 through 2012 was generally uninformative due to very small sample sizes and that for 2013 was similar to those in 2008 and 2009 though at a lower level. Dogfish collected on the spring 2008 survey ranged from 18cm to 87cm PCL, and two distinct modal groups were again observed. Juvenile fish, while present, were much less abundant on the spring 2009 cruise. For both spring surveys, the size range of most of the adults collected was between 55cm and 80cm PCL. Specimens collected in spring 2010 and spring 2011 had a similar length distribution but generally compacted due to a considerably smaller sample size. The earlier pattern of a small number of juvenile fish and larger numbers of specimens ranging 50cm-85cm was observed during spring 2012 and was especially prominent in 2013.

Spiny Dogfish are known to school by sex, with males most often found in offshore waters and females typically inhabiting shallower waters. NEAMAP SNE/MA sex ratio by size data were consistent with this pattern; nearly all of the Spiny Dogfish collected except at the very small sizes were female (Figures 169, 170). Female Spiny Dogfish are known to grow to larger sizes than do males (Campana et al. 2009) and this is reflected in the sex-specific

length frequencies, sex ratios at size, and in the maturity schedules (though as stated previously the sample sizes for male dogfish are small; Figure 171).

Approximately half of the Spiny Dogfish diet by both weight and number was fishes (Figure 172). The largest 'prey type' within this category was unidentifiable fish followed by a combination of many species of fishes, each of which individually contributed a small amount to the dogfish diet. Atlantic Menhaden, Striped Bass, Butterfish and Scup comprised between 2% and 7% of the diet by weight. Of the remaining prey categories, molluscs (primarily *Loligo* squid) accounted for the greatest percentage of the diet of Spiny Dogfish.

Beginning with the spring 2010 survey cruise, data on the reproductive status of spiny (and smooth) dogfish have been recorded on specimens sampled for 'full workup.' These data include number of embryos/pups present, the development stage ('candle', embryo, pups with yolk sac, pups without yolk sac) and gross weights and individual lengths of any pups present. For 2010 through 2013 combined, the number of pups present in female Spiny Dogfish ranged from 0 to 11 with the non-zero peak being between 4 and 6. About 93% of females (spring and fall combined) were gravid (Figure 173A). Contrary to earlier studies (Hisaw & Albert, 1947) who (in the vicinity of Woods Hole, MA) observed gravid females with only Stages A (candle) and C (pups with yolk sac) during the spring and only Stages B (embryo) and D (pups without yolk sac) during the fall, NEAMAP SNE/MA routinely observes all four stages during both seasons in similar seasonal proportions (though sample sizes during the fall are small; Figure 173B). Length frequencies of pups exhibit two distinct modal groups during both spring and fall (unlike for the Smooth Dogfish this does not appear to merely represent growth between seasons). This is consistent with observations that Spiny Dogfish have gestate for nearly two years, meaning that one group of measured pups is in their first year of gestation and another group is in their second year (Figure 173C).

Spot (*Leiostomus xanthurus*)

Figure 174. Spot biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 60. Spot sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 61. Spot geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured and by age class.

Figure 175. Spot geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys and by age class.

Figure 176. Spot length-frequency distributions, by cruise.

Figure 177. Spot sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 178. Spot maturity at length, by sex for all cruises pooled, 2007-2013.

While traditionally thought of as a southern or Mid Atlantic species, Spot are captured throughout the range of the NEAMAP SNE/MA survey, even into RIS and BIS, though the largest and most consistent catches are normally in Virginia and North Carolina. As noted earlier in this report, during spring 2013 a Spot and an Atlantic Cod were captured during the same tow in Region 5 (NY Harbor area; Figure 174).

Spot are typically one of the most numerous species in NEAMAP SNE/MA cruises with numbers ranging from 1,600 to 29,600 during spring surveys and 6,400 to 210,000 in the fall. A time-series high number captured during fall 2012 was followed by season-specific record numbers in spring 2013 (Table 60). Catches during the fall 2013 cruise were considerably smaller, though as with many species abundance as measured by NEAMAP SNE/MA could be largely affected by environmental factors such as temperature.

With the exception of the very large numbers seen in fall 2012 and spring 2013, abundance indices have varied within a fairly narrow range during both seasons. Age-specific indices may not presently be as reliable as for Spot as for some other species as the age-length keys used to assign age classes use data borrowed from another survey. When the ageing process has been completed for this lower-urgency species NEAMAP SNE/MA-specific ALKs will be developed (Table 61, Figure 175).

Spot captured in NEAMAP SNE/MA tows generally range between 10-20cm FL. Likely due to reasonably fast growth during their first year, to the relatively small maximum size, and to a normally short life span (about 4 years maximum), length frequencies normally do not exhibit obvious size/age cohorts (Figure 176).

Except at small and large size categories, at which very few specimens have been examined, the sex ratio for Spot tends to be about 1:1 (Figure 177). Both sexes are 50% sexually mature at about 17cm and 95% mature at 23.5cm (Figure 178).

Striped Anchovy (*Anchoa hepsetus*)

Figure 179. Striped Anchovy biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 62. Striped Anchovy sampling rates for each NEAMAP SNE/MA cruise.

Table 63. Spot geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 180. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 181. Striped Anchovy length-frequency distributions, by cruise.

Though most abundant in the southern half of the NEAMAP SNE/MA range (especially in spring), Striped Anchovy are seen in most survey Regions. Overall abundance varies over a wide range both within and between seasons. After reaching time series high values in both spring and fall 2012, in spring 2013 this species was nearly absent from survey tows and in fall 2013 the total number captured was the second smallest of the time series (Figure 179, Table 62).

The changes in total numbers captured are reflected in the survey abundance indices. The spring index is likely to be highly influenced by water temperatures and with the exception of the high value in 2012 is typically at a low value. The fall index generally declined between 2007 and 2010, rose dramatically in 2011 and 2012 but then fell again in 2013 to near the low values observed in 2009 and 2010 (Table 63, Figure 180).

As this species is both quite small (maximum size about 18cm) and short lived, length frequency histograms are consistent year-to-year and generally do not exhibit evidence of size cohorts (Figure 181).

Striped Bass (*Morone saxatilis*)

Figure 182. Striped Bass biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 64. Striped Bass sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 65. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 183. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 184. Striped Bass length-frequency distributions, by cruise.

Figure 185. Striped Bass length-frequency distributions, by cruise and sex.

Figure 186. Striped Bass sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 187. Striped Bass maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 188. Striped Bass diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

While currently highly abundant and reasonably susceptible to capture by trawls, due to its particular migratory patterns and to the timing of both the spring and fall NEAMAP SNE/MA surveys Striped Bass are generally not well sampled by the survey. During spring surveys the species generally is found in its spawning aggregations in upper estuaries. After migrating well northward in late spring, most individuals/schools have yet to begin their fall southward migration during the time of the fall survey. That said, the survey does sometimes capture appreciable numbers of Striped Bass and while the abundance indices may be of questionable value some of the biological data can be useful for assessment and management.

Normally more Striped Bass are captured during fall surveys than during the spring and this pattern was true in 2013 when capture rates during both seasons were in the low-to-middle range compared to other survey years. Abundance is usually highest in the northern portions of the survey range but significant numbers can be captured elsewhere as happened in fall 2013 when a moderately large catch of Striped Bass occurred in Region 8 (southern New Jersey; Figure 182, Table 64).

For both seasons, abundance indices have alternated direction up and down on an annual basis, though with a declining trend. Again however the value of NEAMAP SNE/MA abundance indices for this species must be examined further (Table 65, Figure 183).

Most Striped Bass captured were between 55-85cm FL though both very large and much smaller specimens have been sampled (Figure 184). Though this species is known to exhibit sexually dimorphic growth patterns at the moderate sizes which dominate NEAMAP SNE/MA samples little evidence of this is found, except for those relatively few fish in the largest size categories, which are dominated by females (Figure 185, Figure 186). For specimens examined by NEAMAP SNE/MA, 50% of female Striped Bass reach sexual maturity at about 30cm FL while males reach that level at about 34cm. Both sexes achieve the 95% sexual maturity rate at 48-49cm (Figure 187).

Striped Bass sampled by the survey are highly piscivorous with 93.7% by %W and 85.9% by %N of the diets consisting of fish. Bay Anchovy constitute 40%-50% of the diet, with Sand Lances, Butterfish, Scup, and Bluefish also present in significant quantities. Notably, Atlantic Menhaden constitute only about 1% of the diet. Crustaceans and molluscs make up most of the rest of the food items found in NEAMAP SNE/MA samples (Figure 188).

Summer Flounder (*Paralichthys dentatus*)

Figure 189. Summer Flounder biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 66. Summer Flounder sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 67. Summer Flounder geometric mean indices of abundance, for all specimens captured (by number and biomass) and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 190. Summer Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 191. Summer Flounder length-frequency distributions, by cruise.

Figure 192. Summer Flounder length-frequency distributions, by cruise and sex.

Figure 193. Summer Flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 194. Summer Flounder catch-at-age standardized to 3,000 trawl minutes, by cruise.

Table 195. Summer Flounder smoothed age-at-length proportions, based on aged specimens from all cruises between 2007 and 2013.

Figure 196. Summer Flounder maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 197. Summer Flounder maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 198. Summer Flounder diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Summer Flounder were collected from throughout the NEAMAP SNE/MA survey range on each of the 2013 cruises (Figure 189). For both of the survey cruises, Summer Flounder catches were greatest in the northern portion of the sampling area (i.e., off of the coast of Long Island and in BIS and RIS). Small but consistent catches of Summer Flounder were encountered throughout the rest of survey area during both 2013 surveys. In general, however, catches became patchier and declined with decreasing latitude.

It is apparent that the NEAMAP SNE/MA survey gear samples this species well. Catches of Summer Flounder by the NEAMAP SNE/MA Near Shore Trawl Survey were relatively consistent among survey cruises (427 – 1,352 specimens weighing 263 kg to 636

kg; Table 66). In spring 2013 the amounts caught recovered somewhat from the lowest of the time series during 2012 but the fall numbers and biomass were the smallest values in the time series for either season.

After reaching a time series high in spring 2011 the numerical and biomass overall indices for Summer Flounder dropped to their lowest value spring 2012 and remained low in 2013 (Table 61 – Figure 141). Fall survey numerical indices reached a high in 2009 and have followed a declining trend ever since, reaching their lowest value in fall 2013.

Abundance indices for young-of-year (fall only) generally mirrored the overall abundance estimates with an increase from 2007 to 2009, a decline in the succeeding three years, though they recovered somewhat in 2013. Indices for the older age groups (both spring and fall) generally followed a similar pattern, indicating that at least to some degree, NEAMAP SNE/MA abundance estimates for this species may be related to availability to the survey as well as to stock size. It should be noted that age sample processing for 2013 have not yet completed so age-specific indices for that year were generated by application of a year-pooled ALK and are subject to change.

A broad range of sizes of Summer Flounder were collected during the all cruises ranging from 12cm to 78cm TL, with several distinct modal size groups normally evident in each survey (Figure 191). The size ranges collected during the spring surveys were similar to those seen during the fall cruises (15cm to 78cm TL, spring; 12cm to 78cm TL, fall). Because the gear used by NEAMAP SNE/MA collects appreciable numbers of Summer Flounder over a broad size range, it is likely that this survey will prove to be a valuable source of information for this species into the future.

As noted in previous project reports, a distinct trend was evident in the sex ratio of Summer Flounder collected by NEAMAP SNE/MA when examined by flounder size (Figures 192, 193). Specifically, the proportion of females in the sample increased with increasing length. Females began to outnumber males at about 35cm TL, and nearly all fish greater than 60cm TL were female.

Specimens between ages 0 and 13 have been collected during the nine NEAMAP SNE/MA surveys to date with the large majority usually aged 3 and younger (Figures 193, 194). Strong vs. weak year classes do not generally propagate themselves in the successive years as is often seen with other species. For example, the large number of age-0 specimens found in fall 2009 is not evident as age-1s in fall 2010, though the number of age-2s in spring 2011 is exceptionally high.

Though, as noted above this species is known to exhibit sex-specific differences in growth rates, the maturity schedules for males and females in NEAMAP SNE/MA samples are remarkably similar. Both sexes achieve the 50% maturity at 26-28cm TL (age 1.2 assuming a 1 January birthdate) and reach the 95% level at 35-38cm (age 2.4 and 2.8 for females and males, respectively; Figure 196, Figure 197).

Summer Flounder are known piscivores, and the diet of flounder collected by NEAMAP SNE/MA confirmed this classification (Figure 198). Specifically, fishes accounted for 58% of the Summer Flounder diet by weight and 47% by number; a wide array of species comprised this category. Crustaceans (mostly small, shrimp-like animals) and molluscs (mainly *Loligo* squid) composed the remainder of the diet. A similar feeding ecology was recently documented for Summer Flounder in Chesapeake Bay. *Loligo* squid were absent from flounder stomachs collected in the bay, however, likely due to the relative absence of this prey from this estuary.

Tautog (*Tautoga onitis*)

Figure 199. Tautog biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.

Table 68. Tautog sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Table 69. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

Figure 200. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

Figure 201. Tautog length-frequency distributions, by cruise.

Figure 202. Tautog length-frequency distributions, by cruise and sex.

Figure 203. Tautog diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013.

Data summaries for Tautog have not been presented in previous NEAMAP SNE/MA project annual reports. Due to the species' tendency to be associated with structure, trawls are not a highly efficient gear with which to sample Tautog. However, the species is a NEAMAP SNE/MA Priority A species and so what data are available will be reported.

Total survey catches have ranged from 4 to 137 specimens (3.7 – 59.2kg). With such low capture rates it is difficult to summarize location-specific abundance tendencies but generally the species is captured within the northern two-thirds of the survey range (Figure 199, Table 68).

Again due to the low sampling rate abundance indices may not be good indicators of true abundance. However, a comparison of trend lines between spring and fall surveys indicates general agreement between the two with low values early in the survey, relatively higher

values in 2008-2010, followed by a decline. That pattern was broken in 2013 however as the spring index rose in value while the fall index was smaller than that in 2012 (Table 69, Figure 200).

Despite the small numbers, Tautog have been captured over a fairly broad size range (14-65cm TL) with no apparent differences between spring and fall surveys (Figure 201). There does not appear to be a preponderance of either sex either overall or by size category when length frequencies are plotted separately by sex (Figure 202).

Among specimens sampled by the survey, about 45% both by %W and %N of the diet of Tautog consists of crustaceans, mainly a variety of crab species. Molluscs, mainly clams and other bivalves, constitute nearly an equal amount (43% by %W and 36% by %N) with unidentified material (likely originally matter which was once one of the other two categories) the only other prey type of significance (Figure 203).

Weakfish (*Cynoscion regalis*)

Figure 204. Weakfish biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 70. Weakfish sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 71. Weakfish geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 205. Weakfish geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 206. Weakfish length-frequency distributions, by cruise.

Figure 207. Weakfish length-frequency distributions, by cruise and sex.

Figure 208. Weakfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 209. Weakfish catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 210. Weakfish sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 211. Weakfish maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 212. Weakfish maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 213. Weakfish diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

In spring 2013 weakfish were captured at nearly all stations south of Delaware Bay and at about half of the stations between Delaware Bay and Raritan Bay and even into BIS (a significant northward shift compared to earlier survey years). In the fall of 2013 this species was captured in every survey Region but highest concentrations were found from Delaware Bay south through North Carolina (Figure 204).

Catches during fall cruises are consistently higher than during the spring. The largest spring total catch was in 2008, followed by the smallest in 2009, with relatively stable numbers and biomass between 2010 and 2013. Numbers captured during fall surveys have followed an up and down pattern with the largest number taken in fall 2011 but declining significantly in 2012 and rising again to mid-range levels in 2013 (Table 70).

Overall abundance indices for spring surveys declined sharply between 2008 and 2009 and rose modestly in 2010 and 2011 (2008 indices were heavily influenced by a small number of very large catches) before reaching a high value in 2012 before falling somewhat in 2013 (this pattern was observed in other sciaenid species as well and may reflect environmental conditions). Until 2013 fall indices have alternately risen and fallen each year but declined in both 2012 and 2013. As the survey catches are dominated by age-0 and age-1 fish, the age-specific indices generally follow the patterns seen for the total catch. Spring and fall trend lines seem to follow opposite patterns of up and down years but upon further examination this may actually reveal a consistency. The young weakfish captured during fall surveys would be the same year classes captured during the following spring, so if the pattern were offset by one calendar year there would actually be good agreement in the patterns between the two time series (Table 71, Figure 205).

Weakfish have been captured at sizes ranging between 5cm and 64cm. Examination of length frequencies reveals apparent length (likely age) groups but with significant overlap among modal groups. Considering the known historical size range for this species the observed length frequencies are considerably compressed with the vast majority of specimens captured at less than 30cm (Figure 206). Inspection of sex-specific length frequencies (Figure 152) and sex ratios by size group (Figure 207) reveals an approximate 50-50 sex ratio at all size groups and no pattern of sexually dimorphic growth.

As with the length frequency examination, cruise-by-cruise age-frequencies exposes a stock that appears to be both size and age compressed. In all cruises the large preponderance of captured specimens are between ages 0 and 2. However, it is noted that in fall 2012 more age-3 specimens were captured (based on the expanded subsample) than in any previous cruise and in both spring and fall 2013 more age-4 weakfish (again, as based on the expanded subsample) than in any previous year, though the numbers were still very small. These are the survivors of what was apparently a successful year class in 2009 (Figure 208, Figure 209).

At most size classes NEAMAP SNE/MA captured weakfish show a preponderance of female fish at approximately a 60:40 ratio (Figure 210). It is unknown whether this is true for the entire stock or whether this is a survey-specific phenomenon.

Weakfish (both males and females) achieve a 50% maturity rate at 18-19cm TL and are 95% at 24cm (females) and 30cm (males; Figure 211). These values correspond to ages 1.1 (females) and 1.4 (males) at 50% maturity and 1.8 (females) and 2.8 (males) at 95% mature specimens (Figure 212). This relatively large difference in age at maturity bears further investigation.

Weakfish are known to be significantly piscivorous. While this is confirmed (Figure 213) from examination of stomachs sampled by NEAMAP SNE/MA (46% by weight, 28% by number, dominated by species of anchovies), at the sizes of fish generally sampled by NEAMAP SNE/MA thus far crustaceans actually contribute the largest portions to the diet of this species (47% by weight, 67% by number, primarily mysids).

White Shrimp (*Litopenaeus setiferus*)

Figure 214. White Shrimp biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 72. White Shrimp sampling rates for each NEAMAP SNE/MA cruise.

Table 73. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 215. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 216. White Shrimp length-frequency distributions, by cruise.

Though also caught almost exclusively during fall NEAMAP SNE/MA surveys, White Shrimp are generally more abundant in the survey than are Brown Shrimp and their range within the survey area is somewhat larger (Figure 214). Total catches in spring surveys have ranged from 0 (three years) to 109 (in 2013) while those in the fall have varied between 16 specimens (2011) to over 3,300 (2010). The 974 White Shrimp captured in fall 2013 was the second highest of the time series though was approximately equal to total captures in 2008 and 2012 (Table 72).

Abundance indices are highly variable and are without apparent trend (Table 73, Figure 215). Length frequencies likewise are somewhat variable as they can be skewed when catch rates are low. When survey abundance is higher, the survey appears to capture the entire size range of the fishable stock (Figure 216).

Windowpane Flounder (*Scopthalmus aquosus*)

Figure 217. Windowpane Flounder biomass (kg) collected at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 74. Windowpane Flounder sampling rates for each NEAMAP SNE/MA cruise.

Table 75. Windowpane Flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 218. Windowpane Flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 219. Windowpane Flounder length-frequency distributions, by cruise.

Figure 220. Windowpane Flounder length-frequency distributions, by cruise and sex.

Figure 221. Windowpane Flounder sex ratio, by length group, for all cruises pooled, 2012-2013.

Figure 222. Windowpane Flounder maturity at length, by sex for all cruises pooled, 2012-2013.

Windowpane Flounder are captured consistently and over a broad geographic range within the survey area. The species is managed within the NEFMC's groundfish complex and is thought to be a potential 'choke species' which could prevent fishing for other more valuable species. It was not originally a NEAMAP SNE/MA Priority A species but because it is a managed species with important potential management implications, VIMS promoted it to 'A' status in 2012.

In spring 2013 Windowpane Flounder were captured in all survey Regions but at consistently higher along the southern coast of Long Island. During the fall 2013 survey catch rates were somewhat patchier but again the species was sampled in every Region (Figure 217). Total number and biomass sampled during surveys is of the same magnitude in both spring and fall and has varied within relatively narrow bounds (Table 74).

Spring abundance indices have followed a moderate but steady declining trend over the survey time series. Those for the fall have been more variable but are currently near the time series low value (Table 75, Figure 218).

Length frequency histograms provide evidence of a small (likely young-of-year) cohort in survey samples, especially during the spring. When age structures analysis is complete this can be verified and appropriate age-specific indices will be provided (Figure 219). Though

only two years of sex-specific length data are currently available, little evidence is seen of the sexual dimorphism that is common among other flatfishes (Figure 220, Figure 221). Similarly, males and females reach sexual maturity at remarkably similar sizes; 50% are sexually mature at 90cm TL and 95% at 27cm (Figure 222).

Windowpane diets (based so far on two years of analyzed stomachs) consist nearly exclusively (about 83% by %W and 90% by %N) of small crustaceans, primarily mysids, sand shrimp, and cumaceans (Figure 223). Fishes, primarily bay anchovy constitute the largest portion of the remainder of the diets.

Winter Flounder (*Pseudopleuronectes americanus*)

Figure 224. Winter Flounder biomass (kg) collected at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 76. Winter Flounder sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise strata used for calculation of abundance indices.

Table 77. Winter Flounder geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP SNE/MA surveys.

Figure 225. Winter Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP SNE/MA surveys.

Figure 226. Winter Flounder length-frequency distributions, by cruise.

Figure 227. Winter Flounder length-frequency distributions, by cruise and sex

Figure 228. Winter Flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

Figure 229. Winter Flounder catch-at-age standardized to 3,000 trawl minutes, by cruise.

Figure 230. Winter Flounder sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 231. Winter Flounder maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 232. Winter Flounder maturity at age, by sex for all cruises pooled, 2007-2013.

Figure 233. Winter Flounder diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Winter Flounder are nearly always captured in the largest numbers in the Sounds and this pattern held in 2013 (Figure 224). In spring however, this species was consistently captured

down to the mid-New Jersey coast and specimens have been captured well south of the 'index' regions.

While significant numbers of Winter Flounder are seen in both spring and fall surveys, total numbers captured in spring are typically three to four times higher than in the fall. While natural variations are observed, over the survey time series thus far, catch rates for this species have been relatively constant within the seasonal surveys, though the 2013 surveys saw the lowest catch totals for each season thus far (Table 76).

For the first four spring survey years (2008-2011) Winter Flounder abundance indices for all specimens combined were relative stable. However the index declined by roughly one-half in 2012 and remained at that level in 2013. Fall indices have been somewhat more variable but appear to be on a downward trajectory. Due to the considerably smaller number of specimens captured in the fall compared to spring, age-specific indices are limited to ages 1 through 4+ for the fall whereas they can be distinguished with some level of confidence for ages 1 through 7+ (which matches the current assessment practice) for the spring (Table 77, Figure 225).

A wide range of sizes of Winter Flounder (7cm – 50cm) have been captured. Length frequency figures typically exhibit a pattern with obvious modal groups, presumably age classes, and the pattern is typically more pronounced in the fall than in the spring (Figure 226).

As is typical of many Pleuronectiform fishes, sexually dimorphic growth, with females typically growing faster and to larger maximum sizes, is seen in examination of sex-specific length frequencies (Figure 227) and sex ratios by size group (Figure 230).

Winter Flounder between ages 0 (a single specimen) and 19 (2 specimens) have been captured during NEAMAP SNE/MA cruises. Most specimens captured are younger than age-6 to age-7 (Figures 228, 229).

Although, as previous mentioned, this species exhibits sexually dimorphic growth patterns the sizes and ages at maturity for the two sexes are very similar. Males and females both reach the 50% maturity rate at 22cm TL and 95% at about 30cm. These sizes correspond to about ages 1.8 and 3.0 (for females) or 3.4 (for males) assuming a 1 January birthdate (Figure 231, Figure 232).

Together, various worms and small crustaceans constitute 70% of Winter Flounder diets by weight and 83% by number. Amphipods constitute the largest identifiable prey type at 29% by weight and 55% by number (Figure 233).

Winter Skate (*Leucoraja ocellata*)

Figure 234. Winter Skate biomass (kg) at each sampling site for 2013 NEAMAP SNE/MA cruises and strata used for calculation of abundance indices.

Table 78. Winter Skate sampling rates and preserved specimen analysis status for each NEAMAP SNE/MA cruise.

Table 79. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 235. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP SNE/MA surveys, for all specimens captured.

Figure 236. Winter Skate length-frequency distributions, by cruise.

Figure 237. Winter Skate length-frequency distributions, by cruise and sex.

Figure 238. Winter Skate sex ratio, by length group, for all cruises pooled, 2007-2013.

Figure 239. Winter Skate maturity at length, by sex for all cruises pooled, 2007-2013.

Figure 240. Winter Skate diet composition, expressed as percent by weight and number collected during NEAMAP SNE/MA cruises in 2007 through 2013.

Winter Skate occurrences in NEAMAP SNE/MA are typically concentrated in the more northern survey Regions but are often quite widely distributed. This was especially true in spring 2013 when water temperatures throughout the survey range were quite cold and this species was captured in the vast majority of tows in every single Region. A somewhat more normal pattern was seen in fall 2013 but even then Winter Skate were captured as far south as southern New Jersey (Figure 234).

While somewhat more Winter Skate are usually sampled during spring surveys than during the fall, the total numbers and biomass captured is remarkably stable over the time series (Table 78). Similarly both the spring and fall survey abundance indices are relatively stable over time, though with some year-to-year variability (Table 79, Figure 235).

Specimens have been captured over a relatively wide size range (9 – 75cm DW). Examination of width frequency histograms reveals what may be size cohorts within the overall structure but this can only be determined once ageing samples are processed (Figure 236). Little evidence of sexual dimorphism exists either in sex-specific width-frequencies (Figure 237), size-specific sex ratios (Figure 238), or maturity schedules (Figure 239), though the largest individuals do have a tendency towards being male.

Crustaceans constitute the largest portions of the diet (36% by %W, 55% by %N) with fishes, worms, and molluscs making up very roughly equal portions thereafter (Figure 240).

Yellowtail Flounder (*Pleuronectes ferruginea*)

As is the case with Atlantic cod, due to the general distribution and habits of Yellowtail Flounder, the number of Yellowtail Flounder captured during NEAMAP SNE/MA cruises is so small that meaningful abundance indices cannot be calculated. However, as this is a Priority A species, other biological data summaries are presented.

Small numbers of Yellowtail Flounder (1-52) have been captured during spring surveys but nearly none have been observed during fall cruises (Figure 241, Table 80). Those captured have been between 13cm to 40cm TL but most fall in the range of 30cm to 44cm (Figure 242). From the limited number of specimens observed it appears that as with many Pleuronectiform species there is a tendency for larger size classes to be dominated by female fish (Figure 243).

Amphipod crustaceans account for about 80% by both %W and %N of Yellowtail Flounder diets. Mysids account for another 5% with the remainder being accounted for by worms and clams (Figure 244). As sample sizes are small, these proportions may change significantly as additional specimens become available.

Public Outreach

In an effort to share survey information with interested parties, such as fishery managers, fishermen and those involved in support industries, other scientists, political figures, students, and the general public, NEAMAP SNE/MA staff use a multi-faceted approach. The centerpiece of these efforts is the survey 'demonstration tows', where guests are invited to observe sampling operations first hand, either in port or for a few hours at sea. During these events, past project reports, current data summaries, and informational brochures are available. Demonstration tows have been conducted during layovers in New Bedford, Massachusetts, Point Judith, Rhode Island, Montauk, New York, Cape May, New Jersey and Hampton, Virginia. Demonstrations in New Bedford are typically conducted as part of that city's annual Working Waterfront Festival. With respect to political figures, guests have included U.S. Senator Sheldon Whitehouse and U.S. Senator Jack Reed, both from Rhode Island, and Brent Robinson, a senior staff member of U.S. Representative Rob Wittman from Virginia. Staff from the offices of U.S. Senators Mark Warner (VA), Charles Schumer (NY) and Mark Begich (AK), and from U.S. Representatives James Langevin (RI), Patrick Kennedy (RI), and Walter Jones (NC), have also attended demonstrations. In all, we estimate that approximately 300 guests have participated in these demonstrations since the inception of the survey in 2007.

A single demonstration tow event was conducted in 2013 and was based out of Point Judith. Admittedly, the number of demonstration tows conducted in recent years has waned somewhat, as extensive efforts put forth in previous years seemed to have satisfied existing demand (i.e., most interested parties have already participated in at least one of these demonstrations). Future demonstration tow events will be conducted as demand reemerges. Outside of the demonstrations, dockside interactions have proven to be an excellent way to share NEAMAP SNE/MA survey data with the fishing communities, and these will continue.

More formally, the ASMFC maintains the official NEAMAP SNE/MA website ([www.NEAMAP SNE/MA.net](http://www.NEAMAP_SNE/MA.net) – referenced in the brochures), which contains an array of background information on the survey and past reports and is expected to offer much more data in the near future. VIMS staff also maintain a site at www.vims.edu/fisheries/neamap. In 2013, PIs and staff made thorough presentations of NEAMAP SNE/MA results at a general meeting of the full Mid-Atlantic Fishery Management Council, the Squid Management Workshop hosted by the Council, an annual meeting of the Commercial Fisheries Research Foundation, the Short-Lived Species Workshop hosted by this Foundation, and annual meetings of the NEAMAP Board and Science and Statistical Committees of the Atlantic States Marine Fisheries Commission New England Fishery Management Council, and ASMFC meetings to date. Further, the lead PI of this program gave a presentation of NEAMAP MA/SNE efforts to the Committee on Natural Resources of the U.S. House of Representatives relative to the upcoming reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act.

Finally, two news articles, one brief and one more in-depth, highlighting the NEAMAP MA/SNE Survey appeared in the June and October issues of the *National Fisherman* in 2013.

Data Utilization/Collaborative Research Efforts

The NEAMAP MA/SNE Trawl Survey has been in operation for 6.5 years as of the time of this report (March 2014), meaning that six spring and seven fall cruises have been completed. As such, the time series of relative abundance data generated by the survey is just beginning to be deemed sufficient to support stock assessment efforts for the MAB and SNE. Specifically, NEAMAP abundance data have been incorporated into the assessments of:

- Atlantic Sturgeon
- Longfin Inshore Squid
- River herring (Alewife & Blueback)
- Summer Flounder
- Winter Flounder

while the biological and life history information that this program yields has been (or is currently being) incorporated into the assessments for a larger number of species. These include:

- American Lobster
- Atlantic Croaker
- Atlantic Menhaden
- Atlantic Sea Scallop
- Atlantic Sturgeon
- Black Drum
- Black Sea Bass
- Bluefish
- Butterfish
- Horseshoe Crab
- Longfin Inshore Squid
- River herring (Alewife & Blueback)
- Scup
- Skates (Clearnose, Little, and Winter)
- Smooth Dogfish
- Summer Flounder
- Spiny Dogfish
- Striped Bass
- Spot
- Tautog
- Weakfish
- Winter Flounder

It is expected that as the time series of data collected by this survey continues to become established, the abundance data for each of the species of management interest collected by the survey will eventually be incorporated into the assessment process. In fact, a number of assessment scientists have indicated that for several more species, NEAMAP MA/SNE abundance data will be incorporated during the next 'round' of assessments. Also, it is anticipated that the number of species for which data is provided to assessments will expand as additional types of data begin to be collected and the assessments for some of the species not listed above are undertaken.

The data and samples collected by NEAMAP MA/SNE also support a number other efforts, some collaborative in nature, that indirectly contribute stock assessment process and/or fishery management plans. These include:

- Hard part (scale/otolith) comparisons for **black sea bass** ageing and subsequent ageing sample exchanges with NMFS & Massachusetts DMF.
- Hard part (scale/otolith) comparisons for both **scup** and **summer flounder** ageing.
- Hard part sampling of American Lobster to develop age data for this species.
- Participation in ageing exchanges with ASMFC partners for **Atlantic croaker** and **spot**.

- Delineation of **butterfish** preferred habitat with NOAA Fisheries, Sandy Hook Laboratory.
- Recording of **longfin squid** sex and maturity data for assessment purposes.
- Investigation of **alewife & blueback herring** population genetics with University of California, Santa Cruz, **Atlantic croaker, black drum, kingfish, & spot** population genetics with South Carolina DNR, **little skate** population genetics with Boston University, **monkfish** population genetics with the University of Madrid in Spain, **silver hake** population genetics with colleagues at VIMS, and **tautog** population genetics with the Virginia Marine Resources Commission.
- Sampling of juvenile **summer flounder** to quantify first year growth and habitat preferences.
- Efforts to improve **alewife & blueback herring** stock assessment in collaboration with University of New Hampshire.
- Identification of contaminants in **Atlantic menhaden** in collaboration with Seton Hall University.
- Investigation of prey species as a source of **Bluefin tuna** contaminant loads.
- Delineation of **coastal bat** populations with the University of Maryland.
- Participation in **coastal shark & Atlantic sturgeon** tagging studies in collaboration with NOAA Fisheries.
- Identification of the prevalence and severity of *Mycobacterium* infection in the coastal migratory population of **striped bass**.
- Quantification of **striped bass** predatory impact in collaboration with the NEFSC and in response to Congressional inquiry.
- Contributions of NEAMAP MA/SNE catch data for **windowpane flounder, winter flounder, & yellowtail flounder** to inform the SMAST Bycatch Avoidance Systems.
- Quantification of the biogeography of Block Island & Rhode Island Sounds with University of Rhode Island to support Marine Spatial Planning efforts (Rhode Island Ocean SAMP).
- Expansion of diet sampling to generate coastwide trophic models in collaboration with SEAMAP.
- Beginning the process of identifying and quantifying possible shifts in species distributions in Northeast waters, in collaboration with the Massachusetts DMF, Maine/New Hampshire, and NEFSC Bottom Trawl Surveys.
- Initiation of efforts to quantify the behavior of fishes (e.g., Longfin squid and flatfishes) relative to the NEAMAP trawl, and in turn develop estimates of capture efficiency/catchability.

A complete listing of the ways in which NEAMAP MA/SNE Trawl Survey data have been utilized is given at <http://www.vims.edu/fisheries/neamapdatause/index>, and this site is typically updated quarterly.

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Figure 1. NEAMAP sampling area including region boundaries and depth strata.

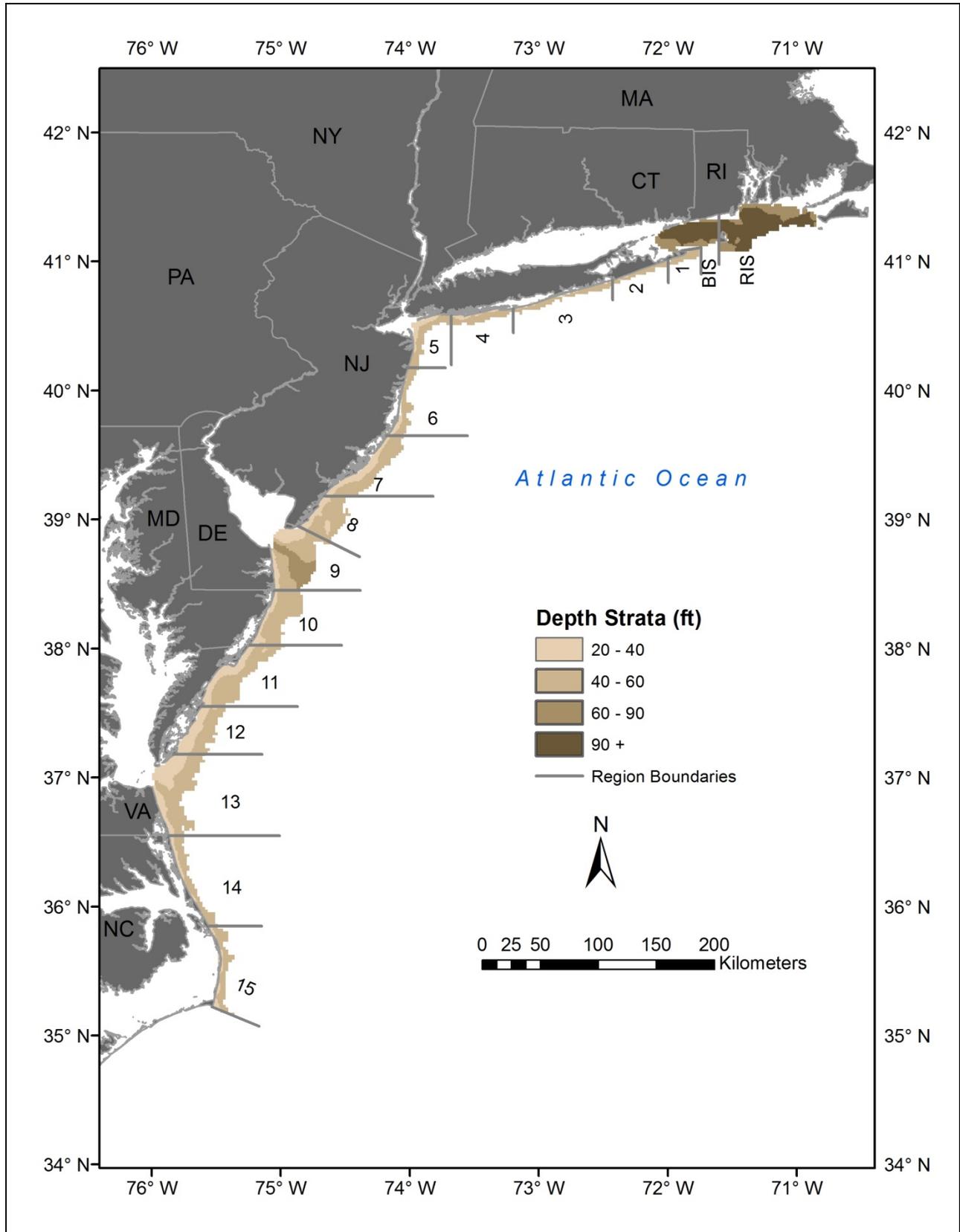


Figure 2A. NEAMAP sampling sites for the spring 2013 cruise. Regional strata are defined by gray lines, while the shapes of the station symbols indicate the depth strata occupied by each.

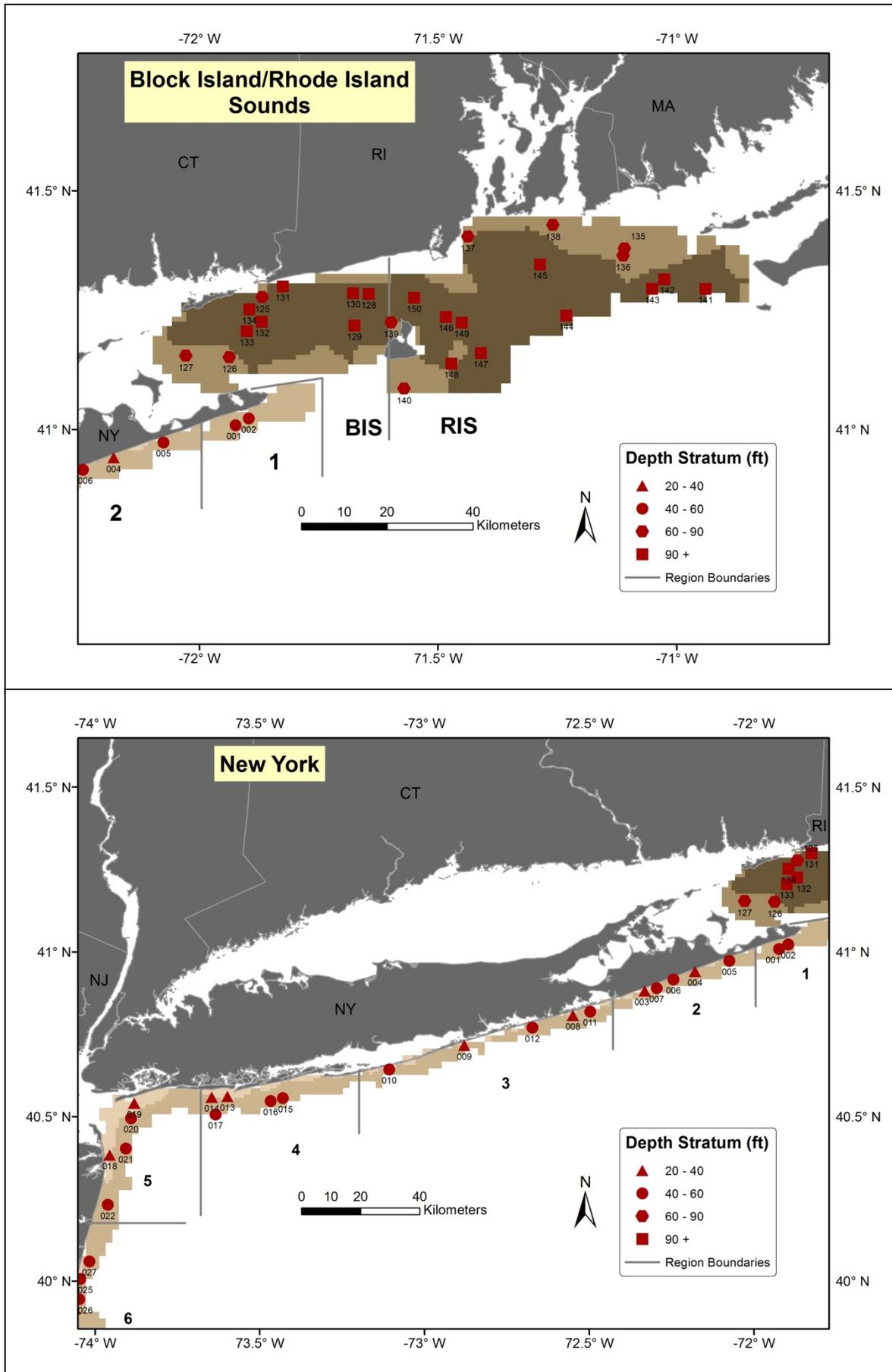


Figure 2A. continued.

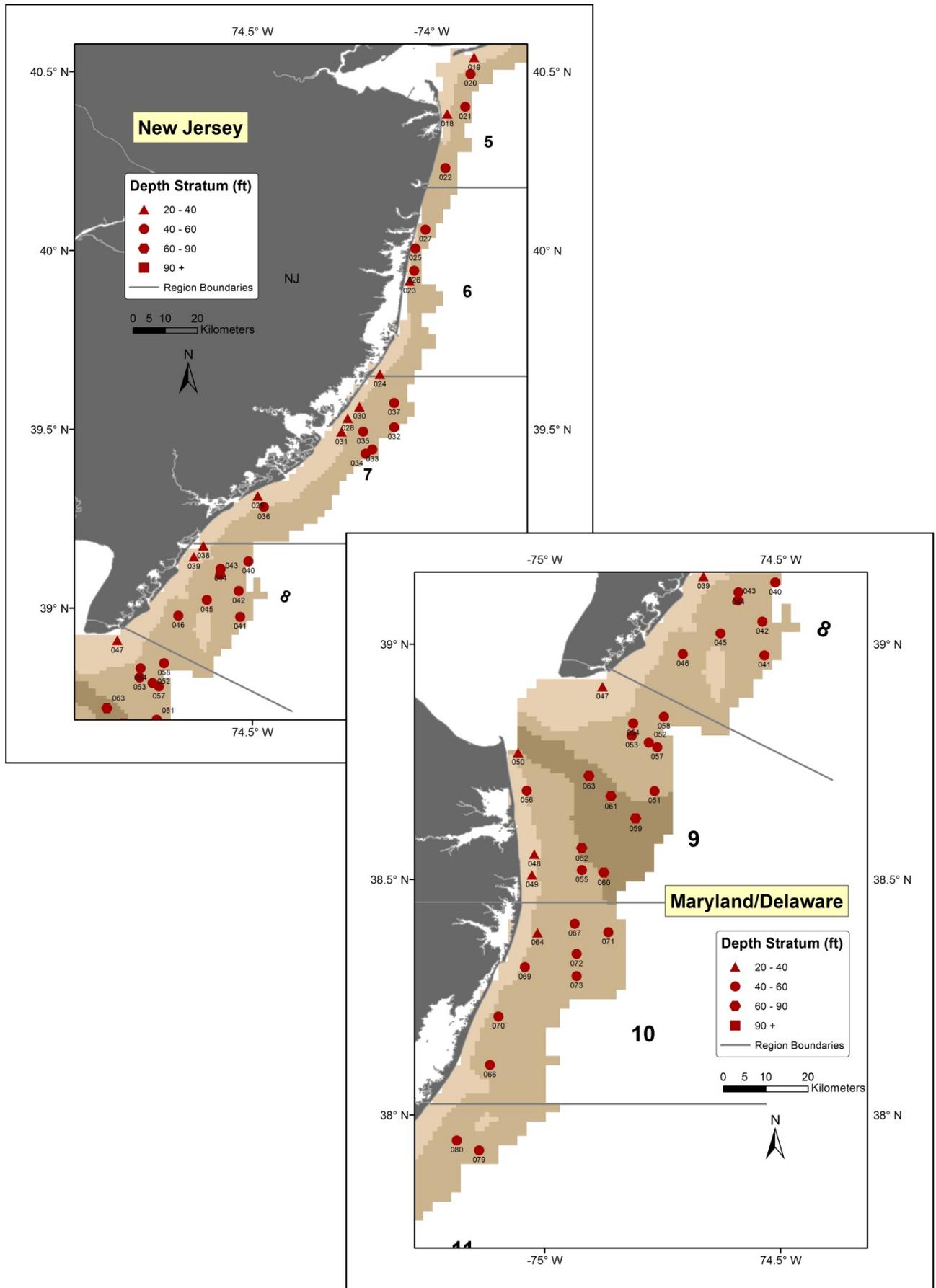


Figure 2A. continued.

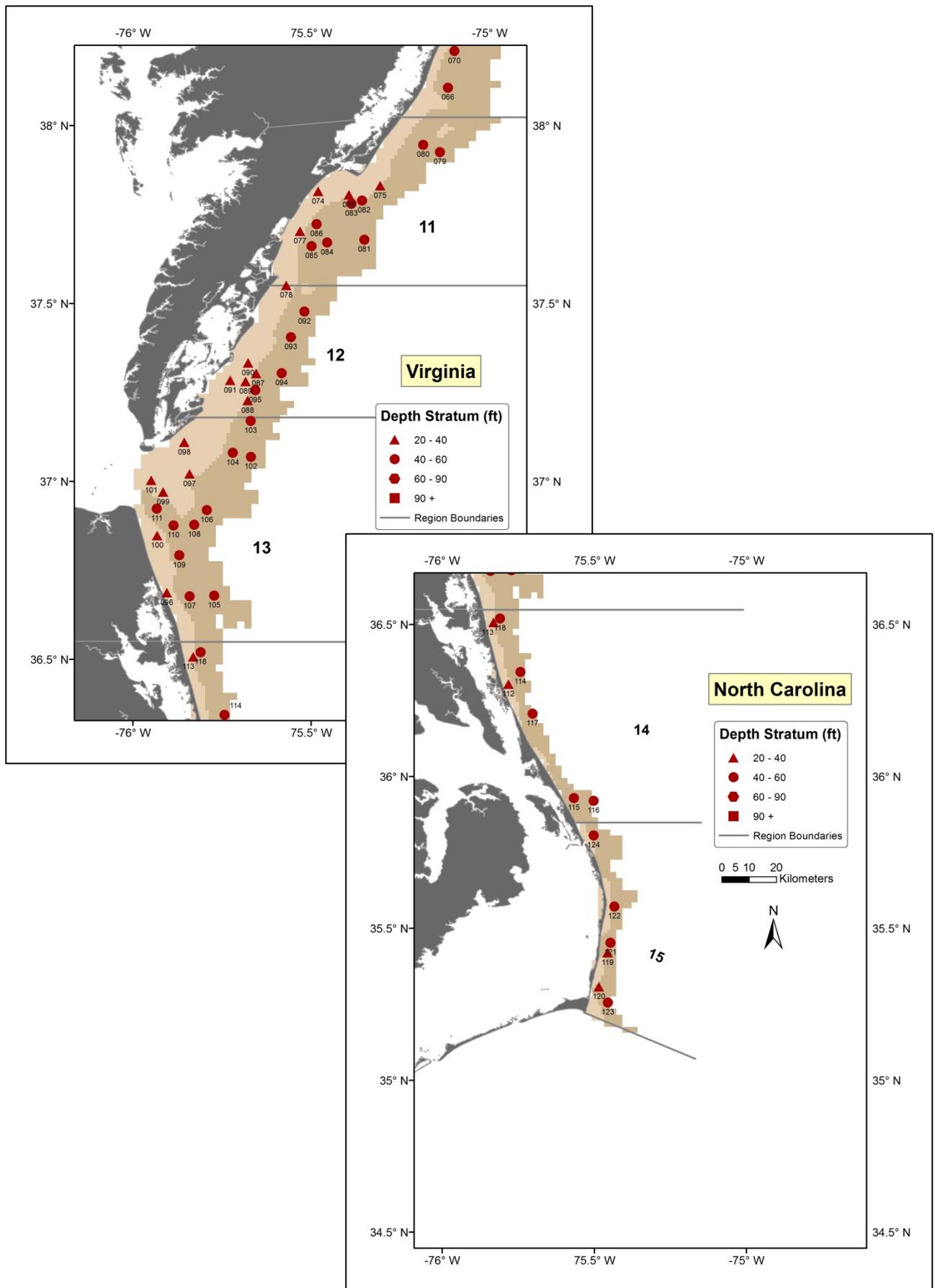


Figure 2B. NEAMAP sampling sites for the fall 2013 cruise. Regional strata are defined by gray lines, while the shapes of the station symbols indicate the depth strata occupied by each.

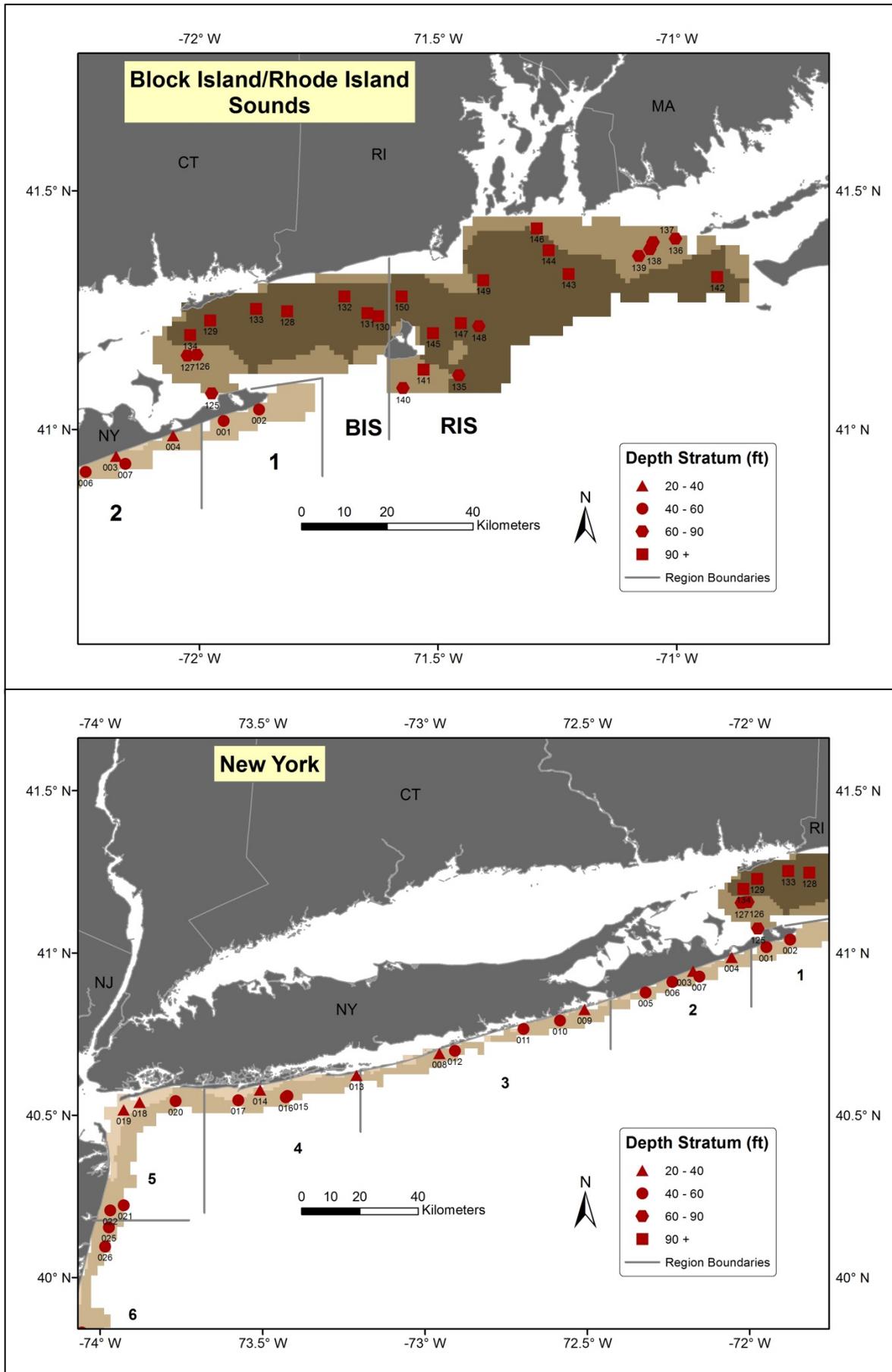


Figure 2B. continued.

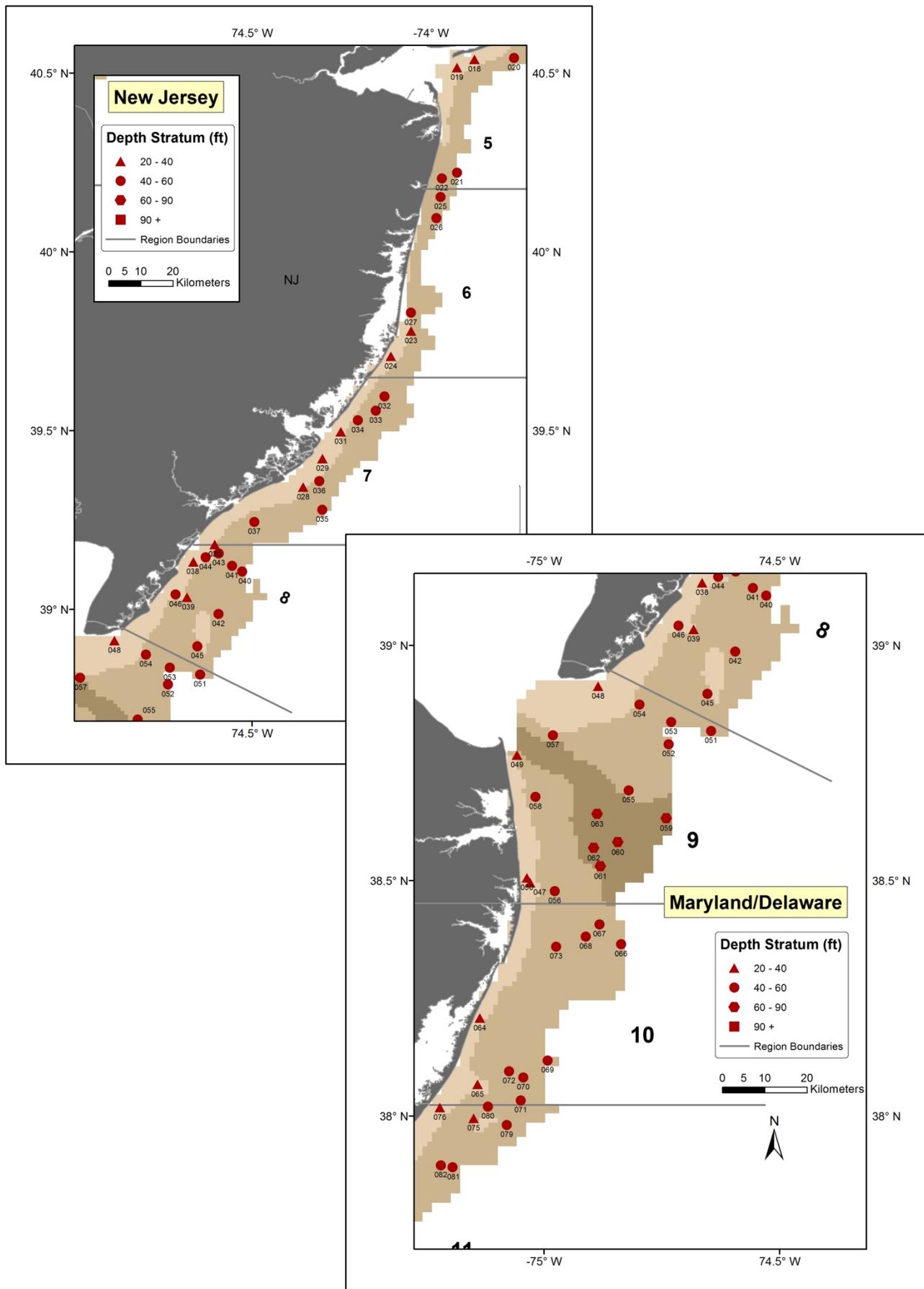


Figure 2B. continued.

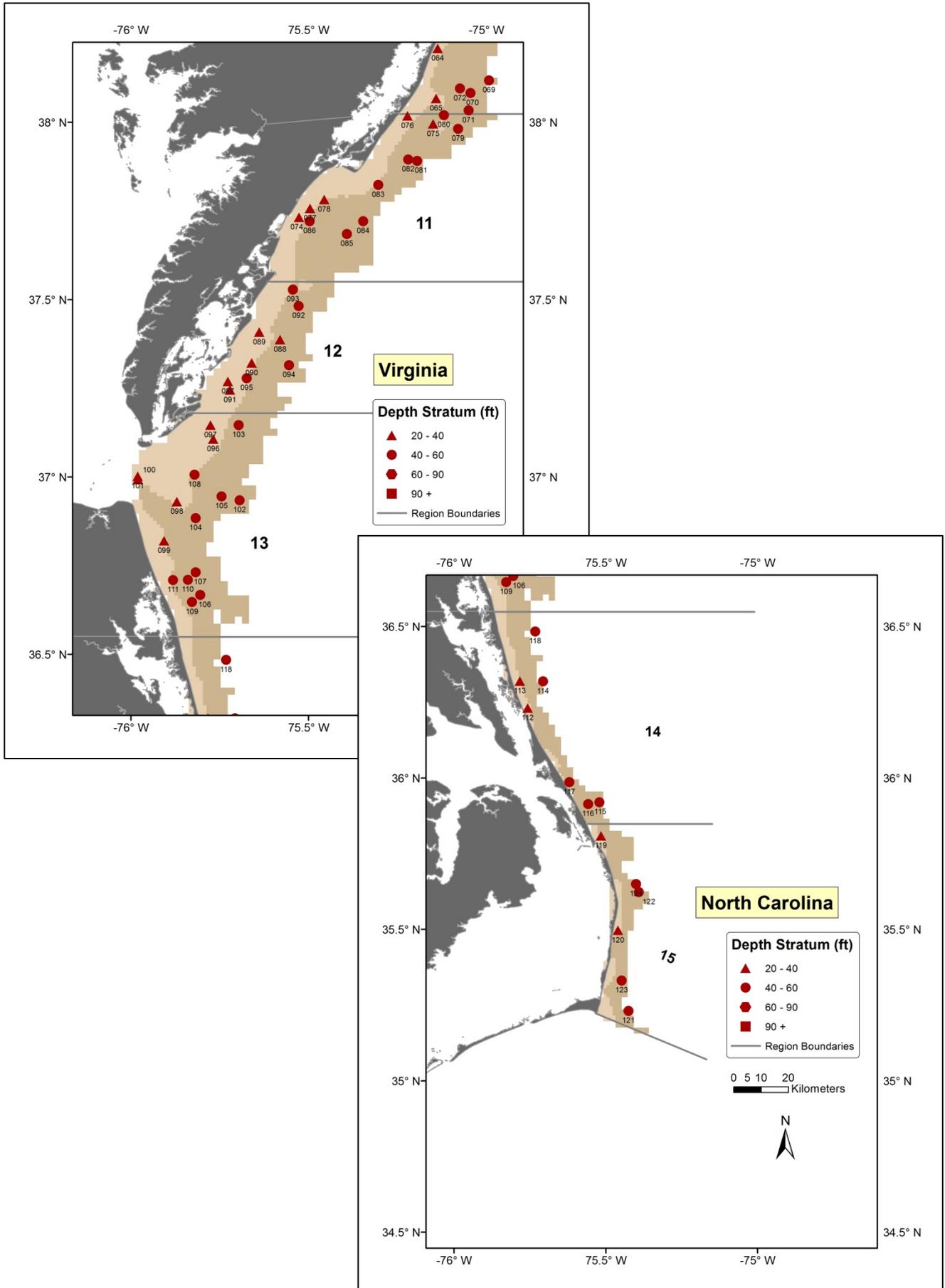


Figure 3A. Bottom temperatures as measured by NEAMAP for spring 2008. (Map 'a' represents measured values averaged over all spring cruises , 'b' gives actual values for spring 2008, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

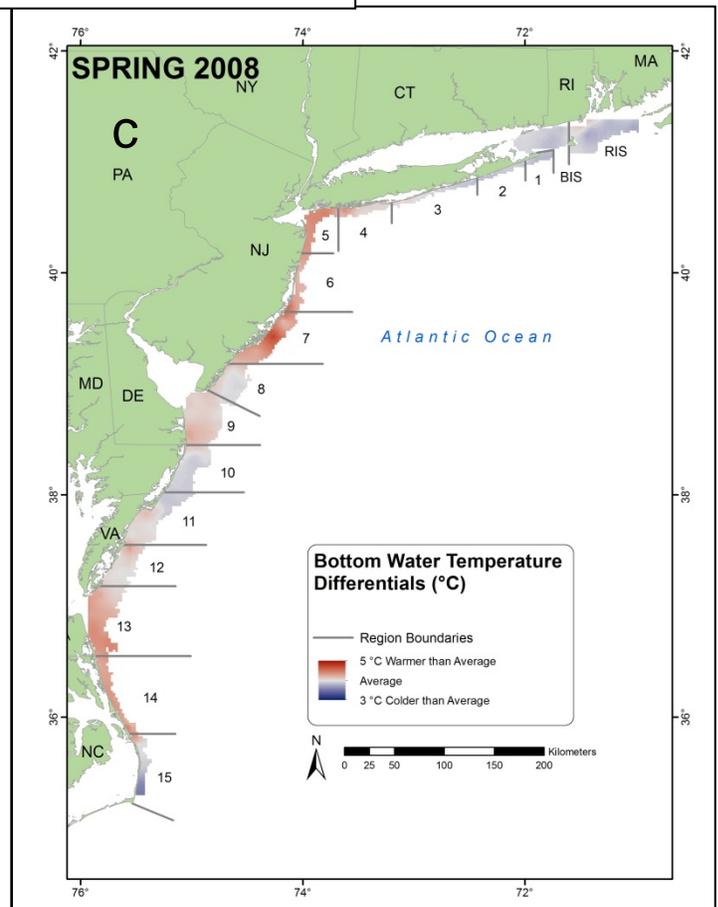
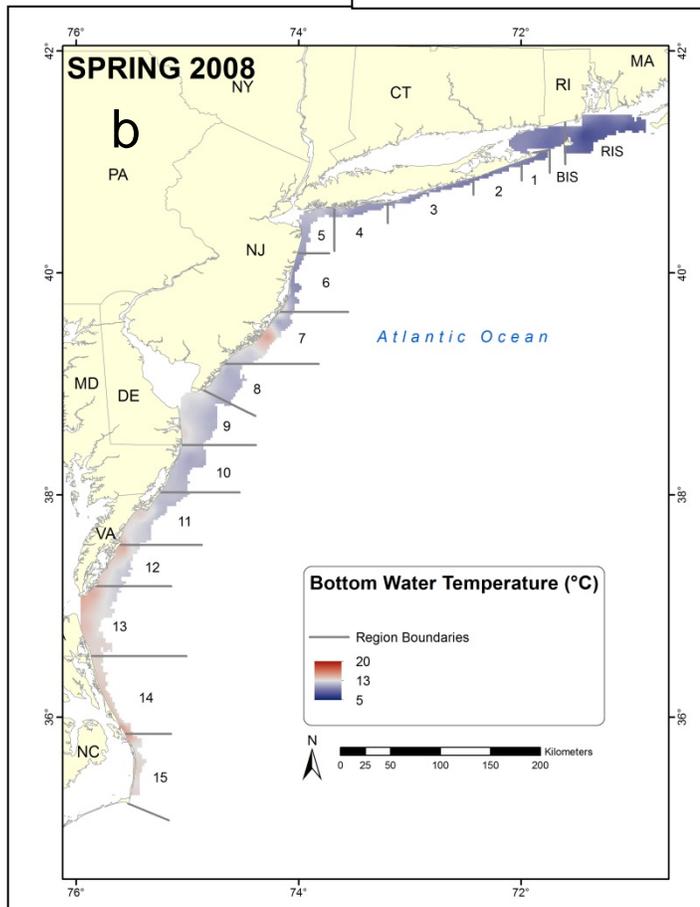
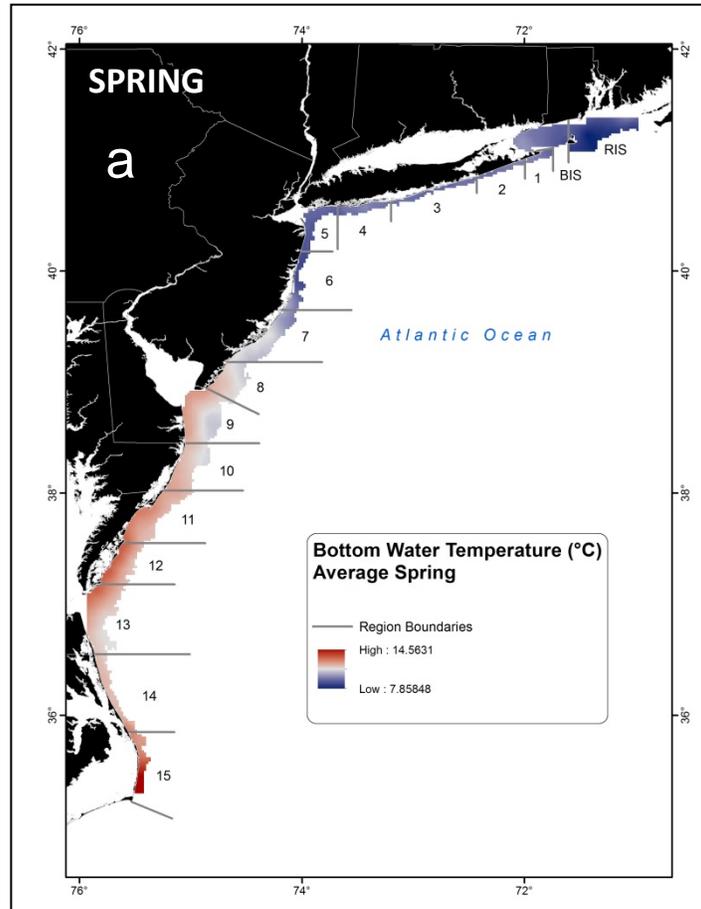


Figure 3B. Bottom temperatures as measured by NEAMAP for spring 2009. (Map 'a' represents measured values averaged over all spring cruises , 'b' gives actual values for spring 2009, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

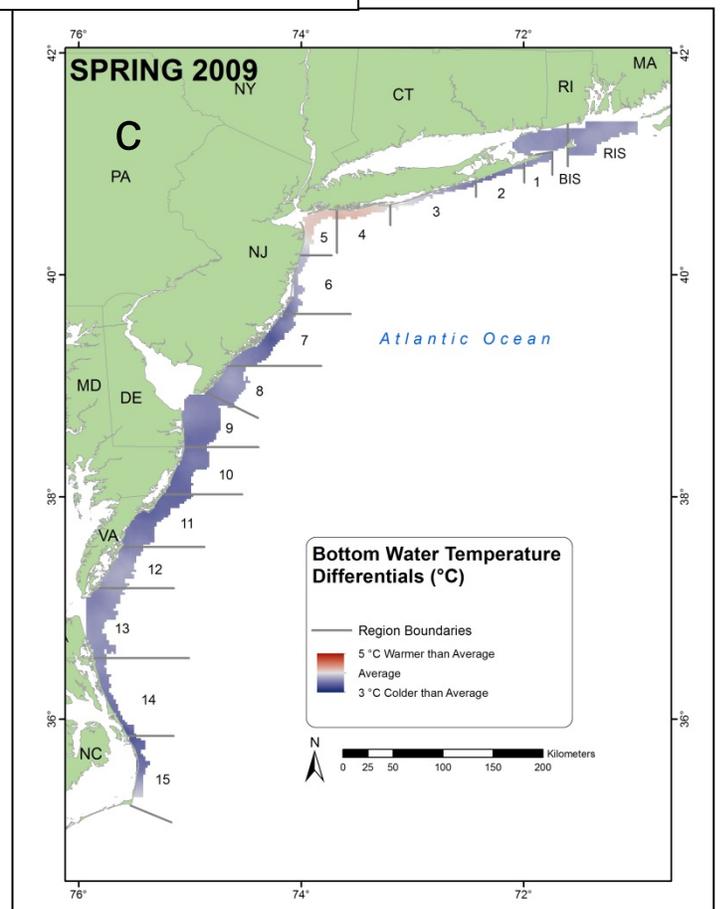
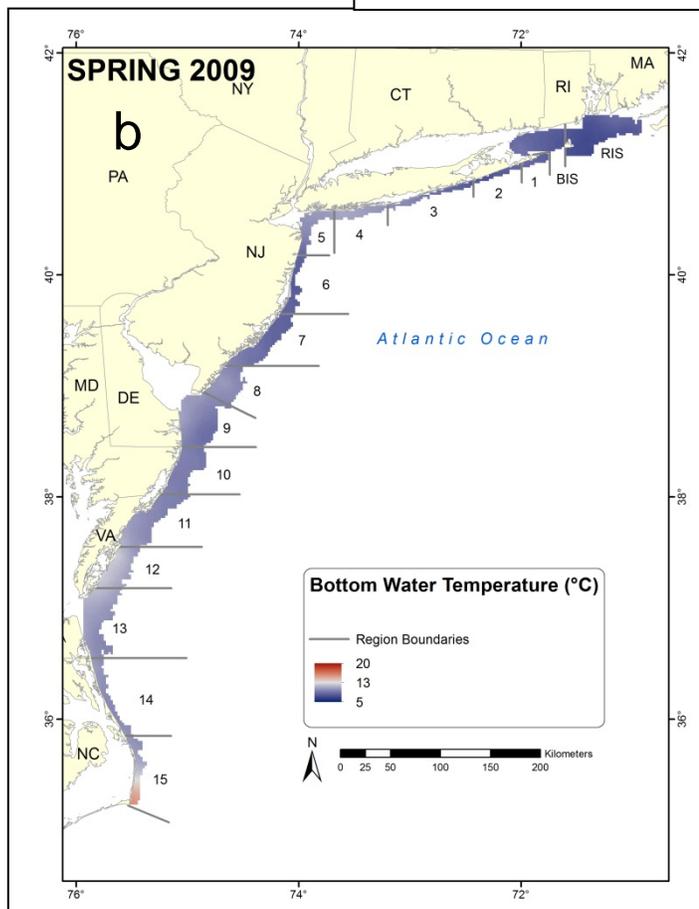
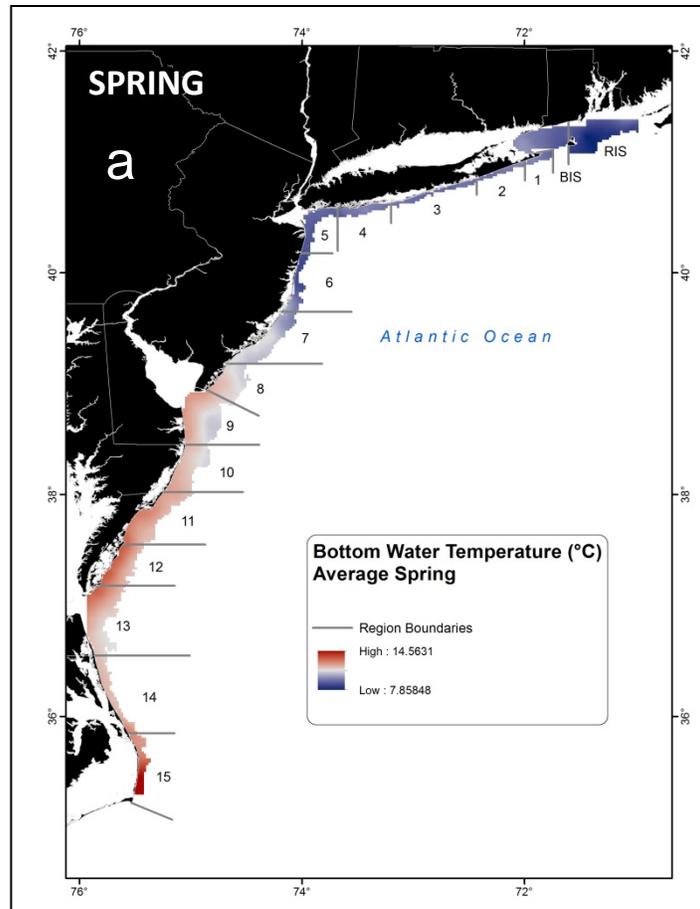


Figure 3C. Bottom temperatures as measured by NEAMAP for spring 2010. (Map 'a' represents measured values averaged over all spring cruises , 'b' gives actual values for spring 2010, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

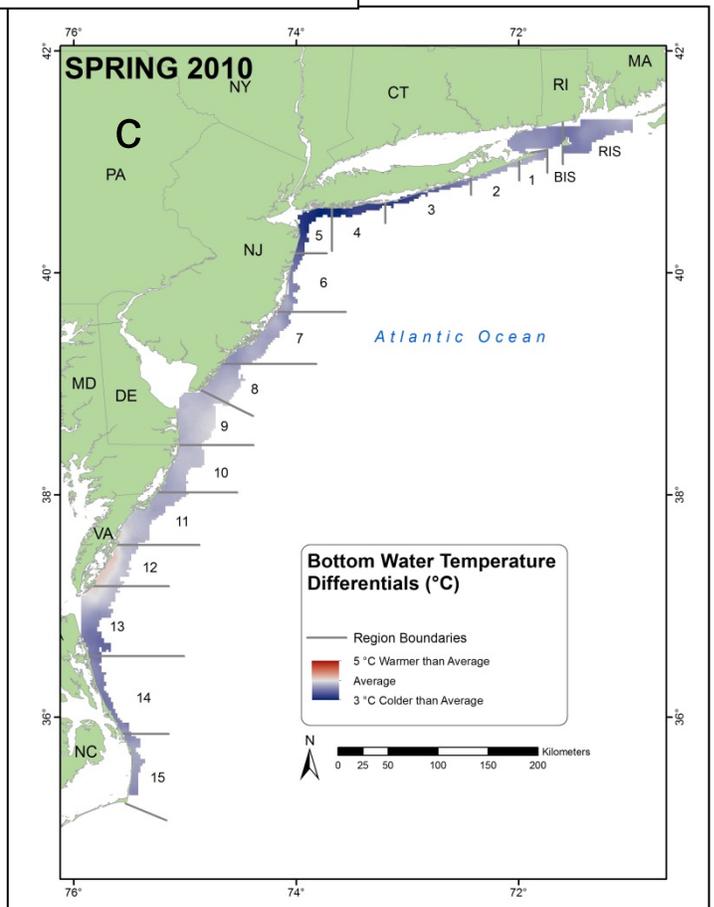
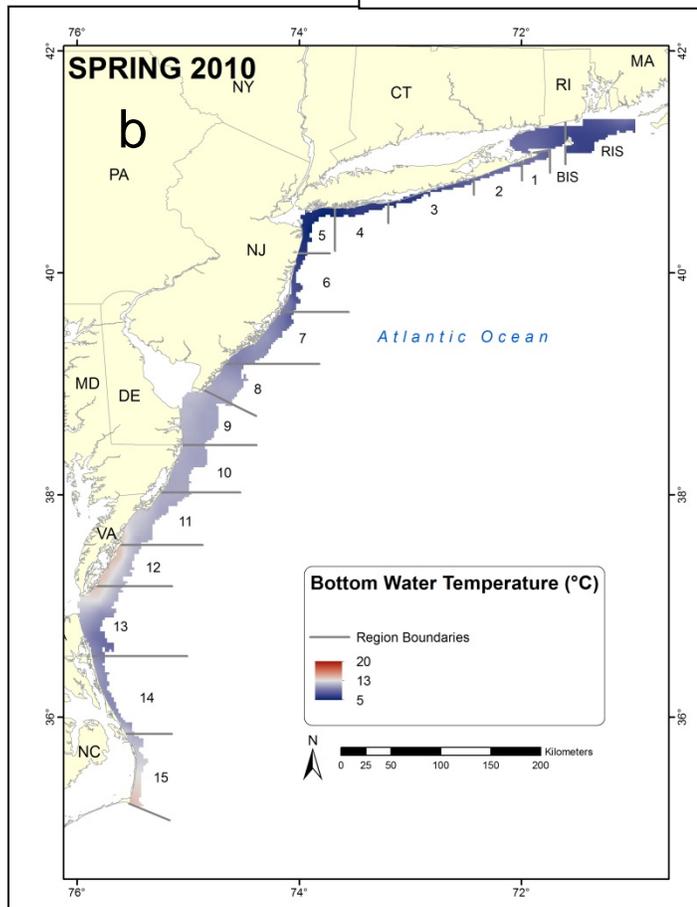
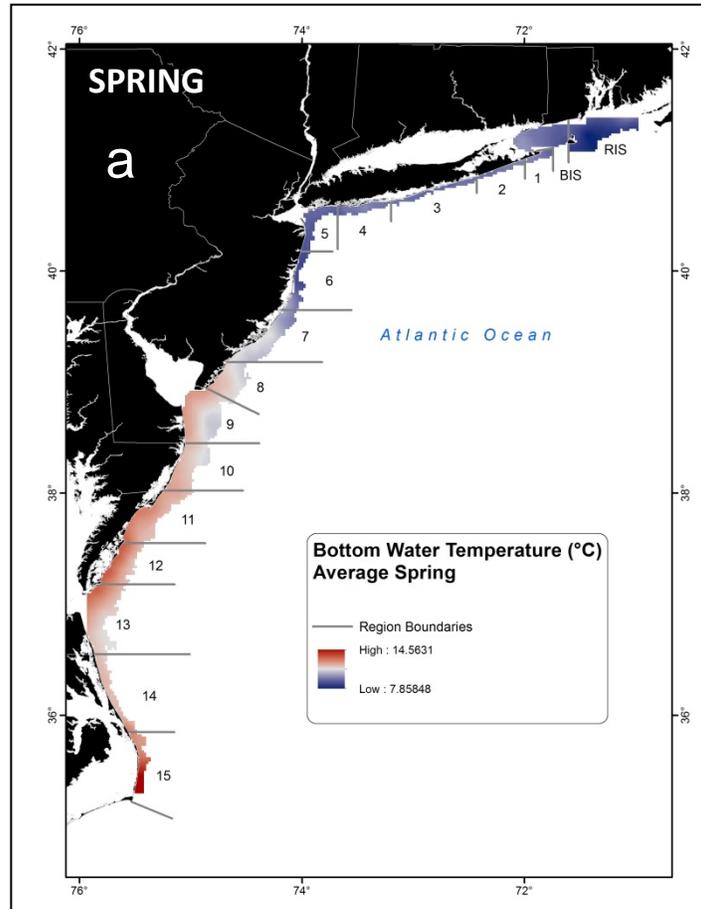


Figure 3D. Bottom temperatures as measured by NEAMAP for spring 2011. (Map 'a' represents measured values averaged over all spring cruises , 'b' gives actual values for spring 2011, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

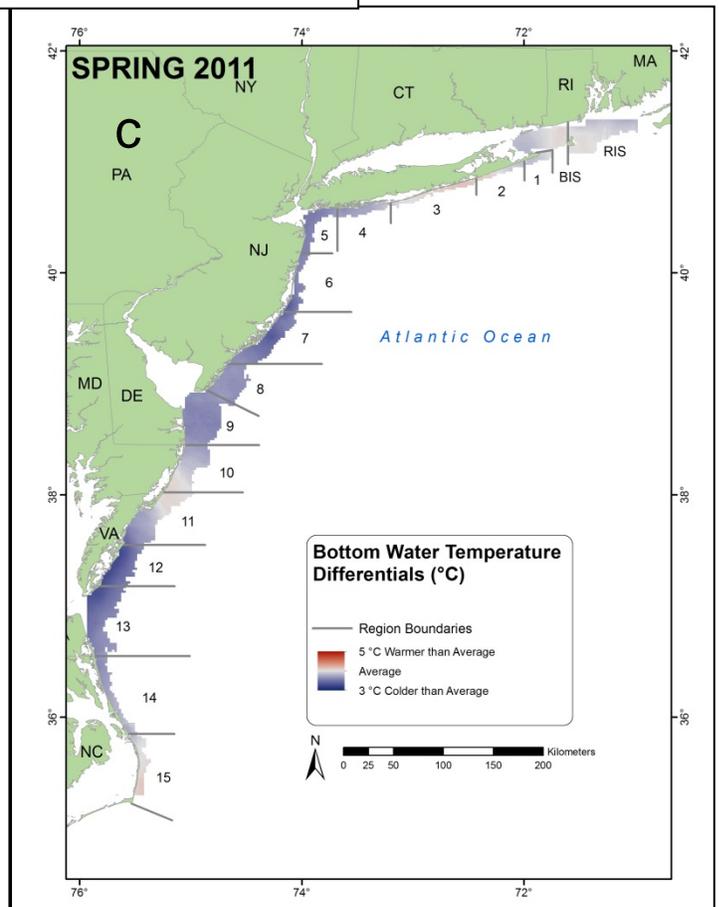
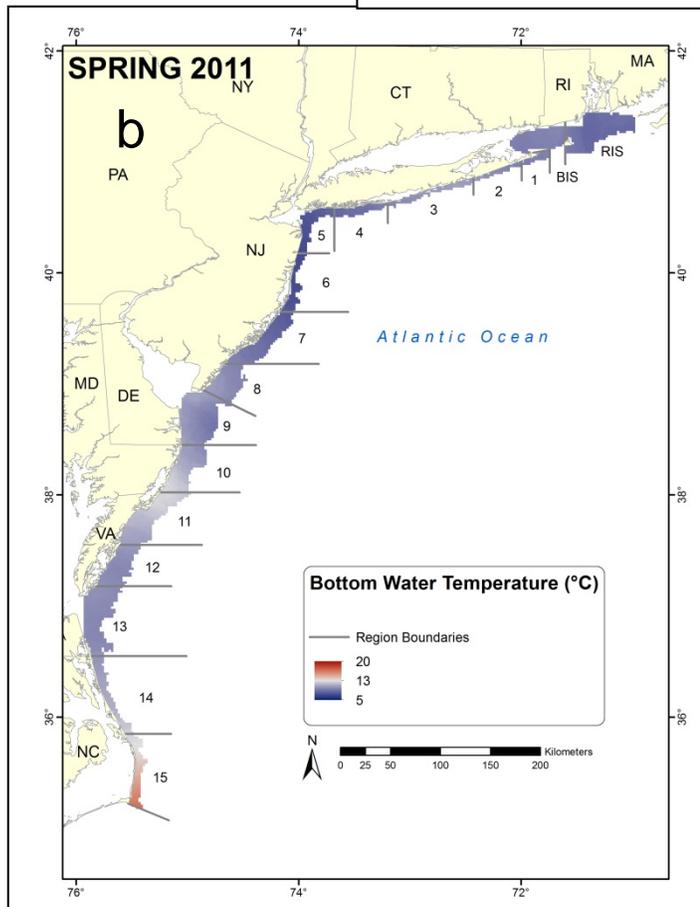
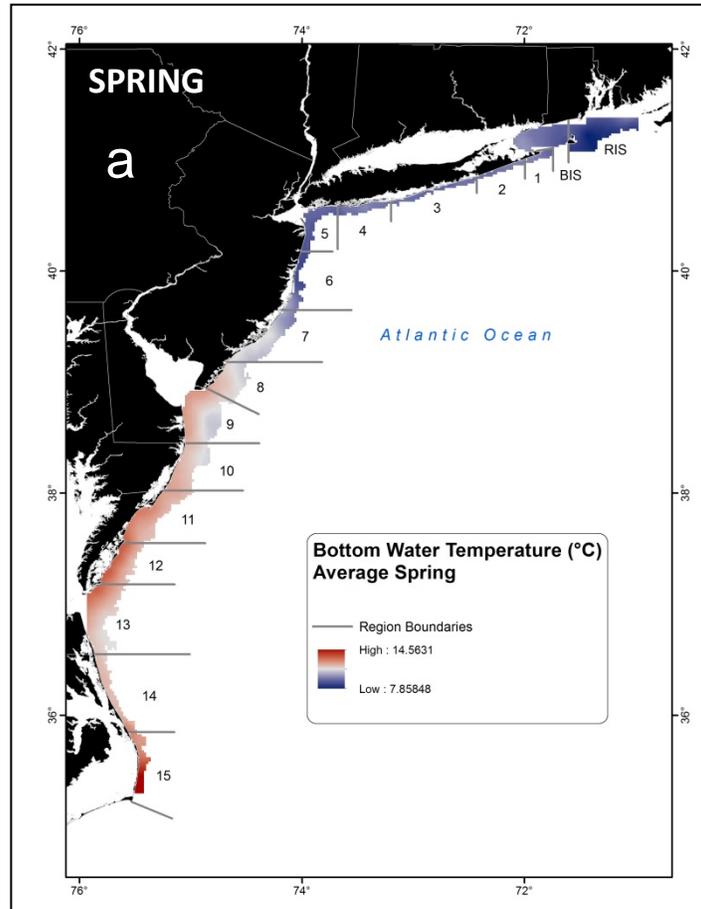


Figure 3E. Bottom temperatures as measured by NEAMAP for spring 2012. (Map 'a' represents measured values averaged over all spring cruises , 'b' gives actual values for spring 2011, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

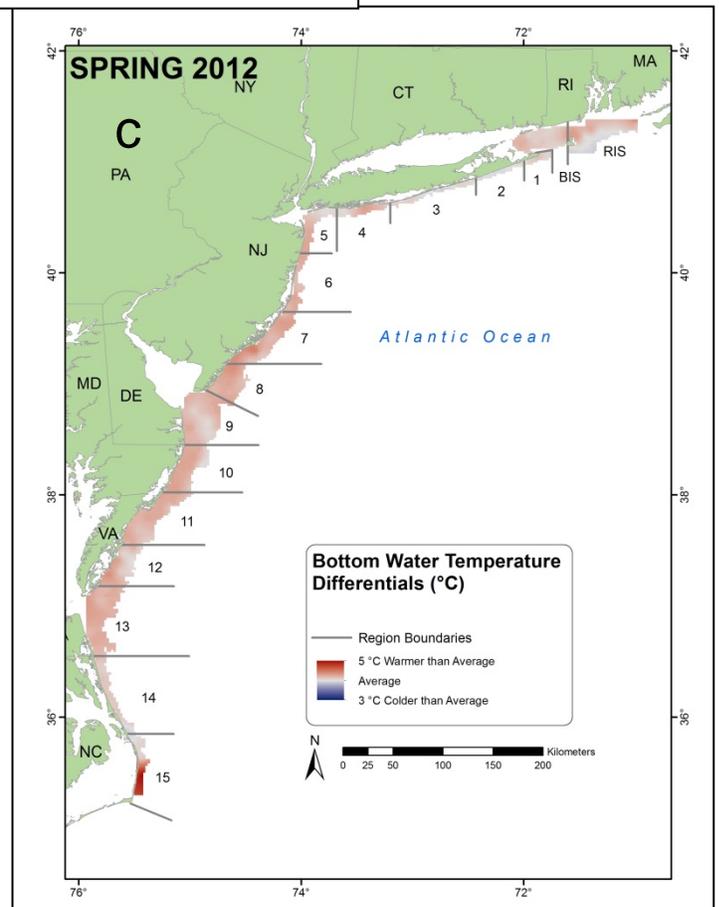
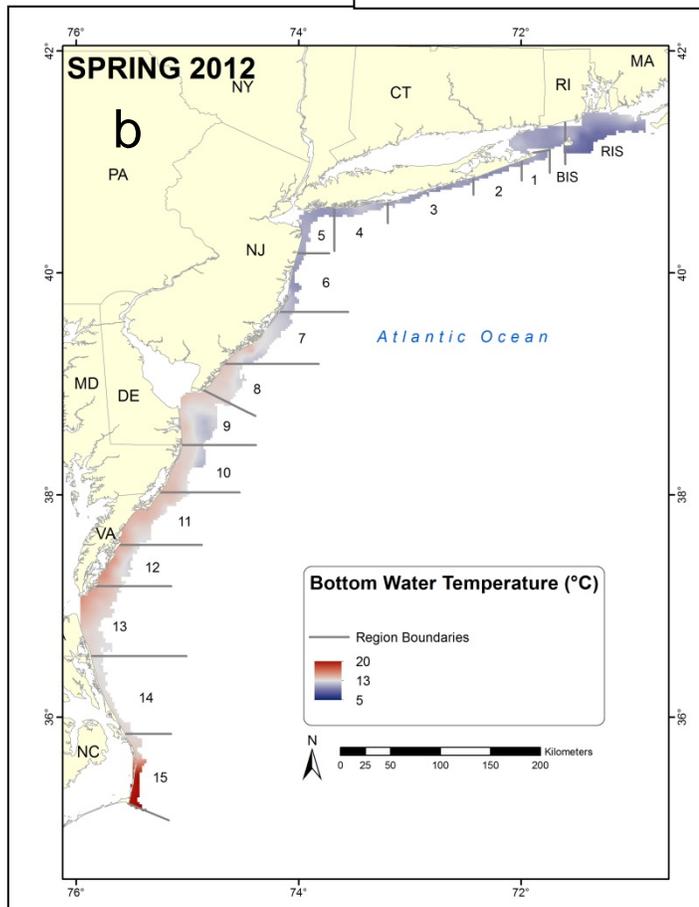
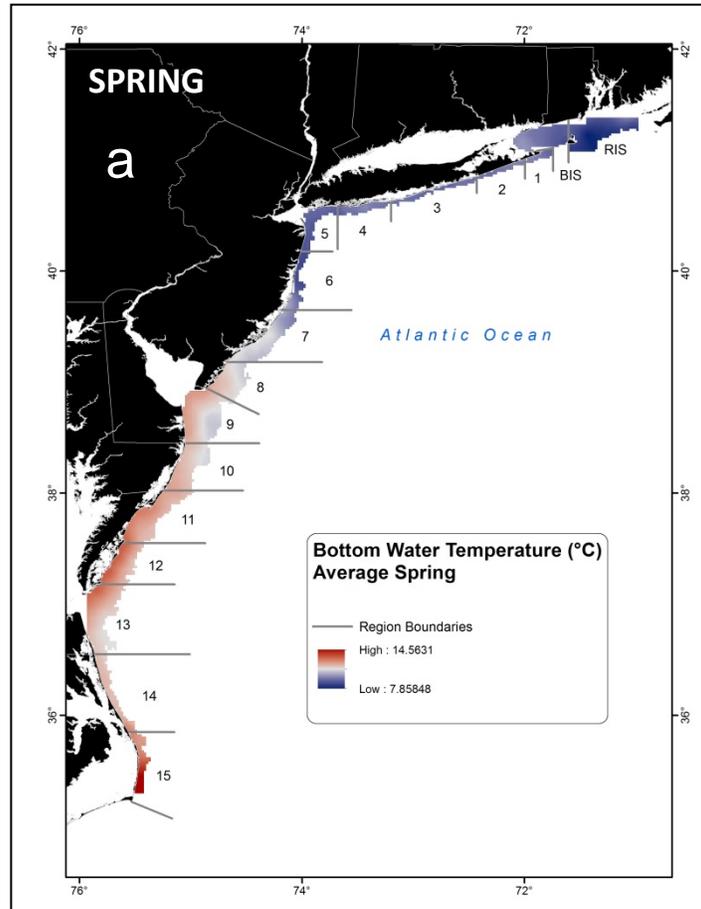


Figure 3F. Bottom temperatures as measured by NEAMAP for spring 2013. (Map 'a' represents measured values averaged over all spring cruises , 'b' gives actual values for spring 2011, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

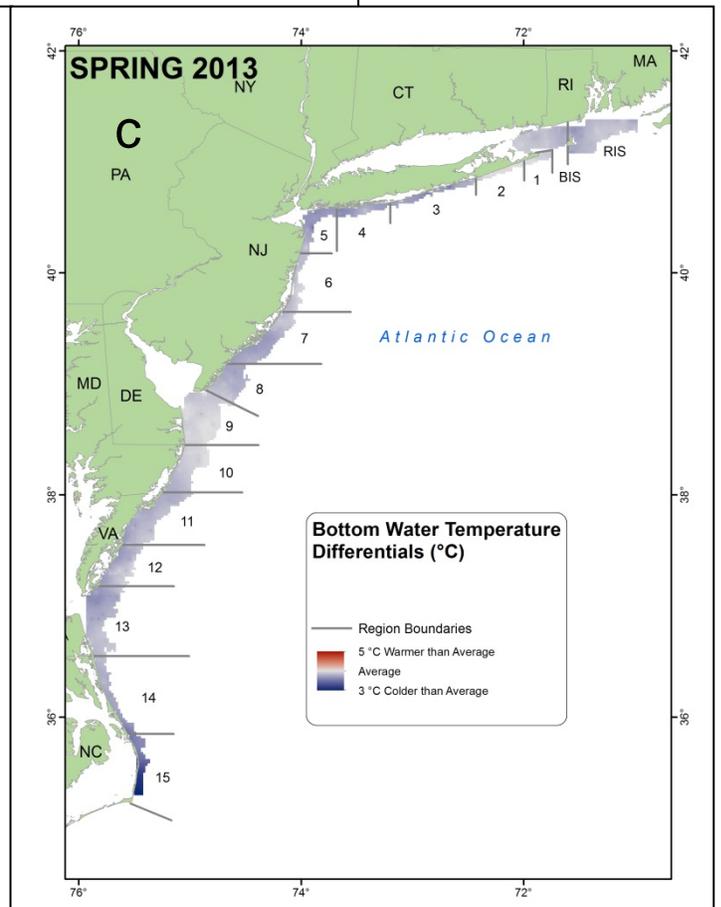
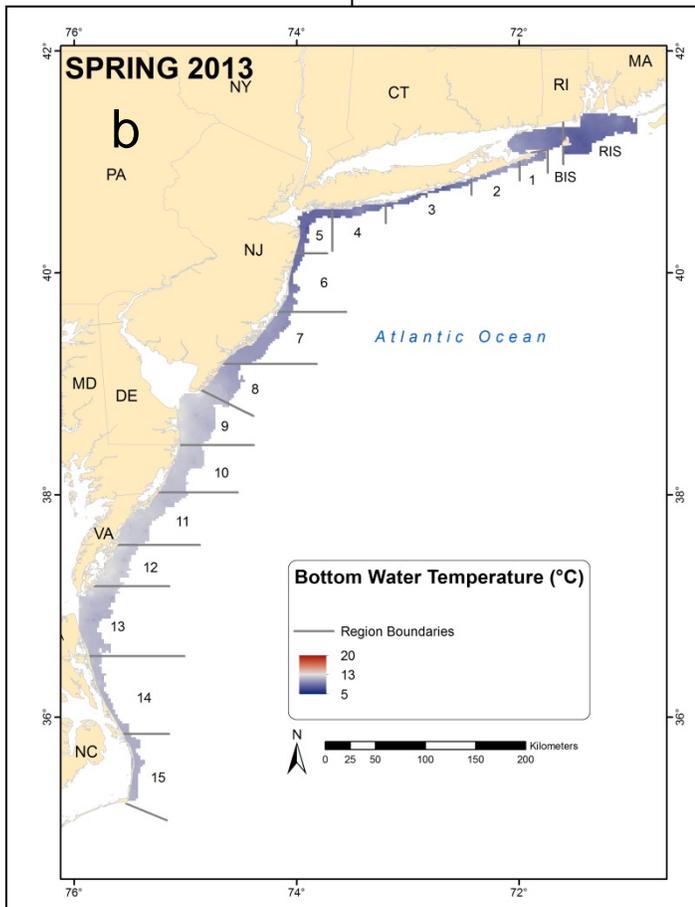
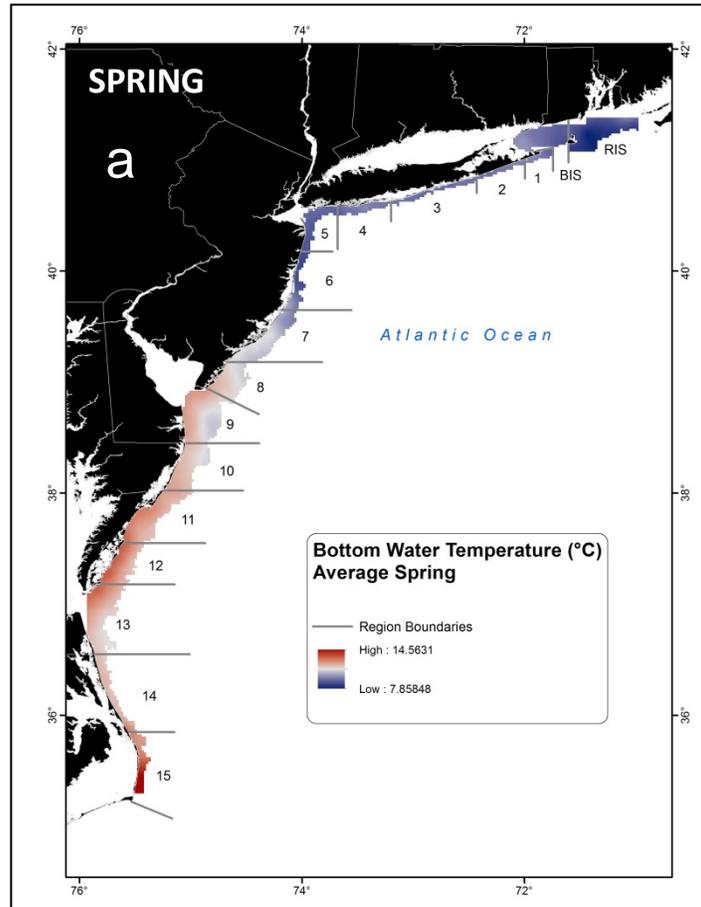


Figure 3G. Bottom temperatures as measured by NEAMAP for fall 2007. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2007, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

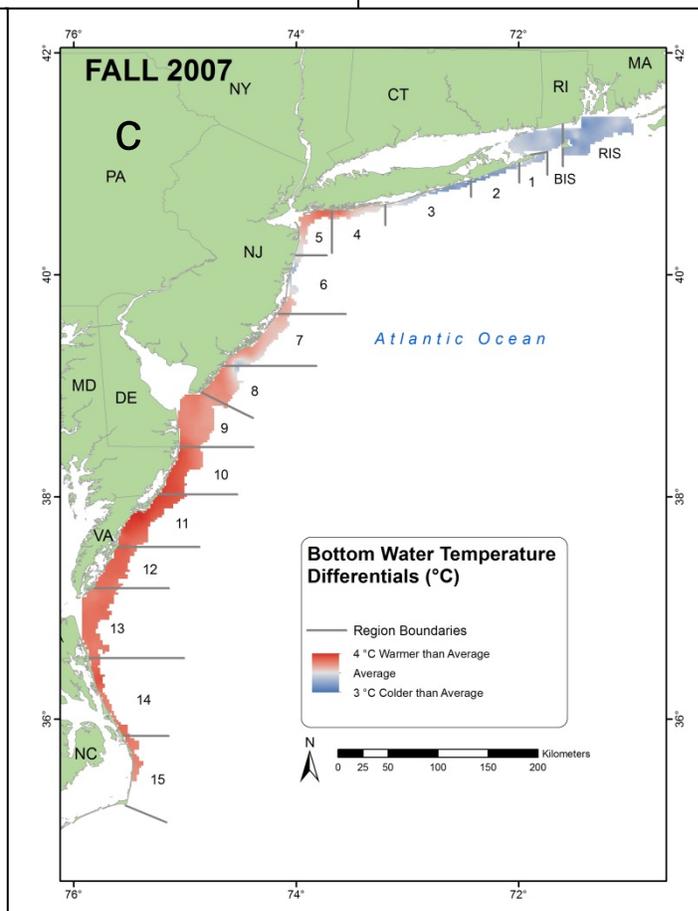
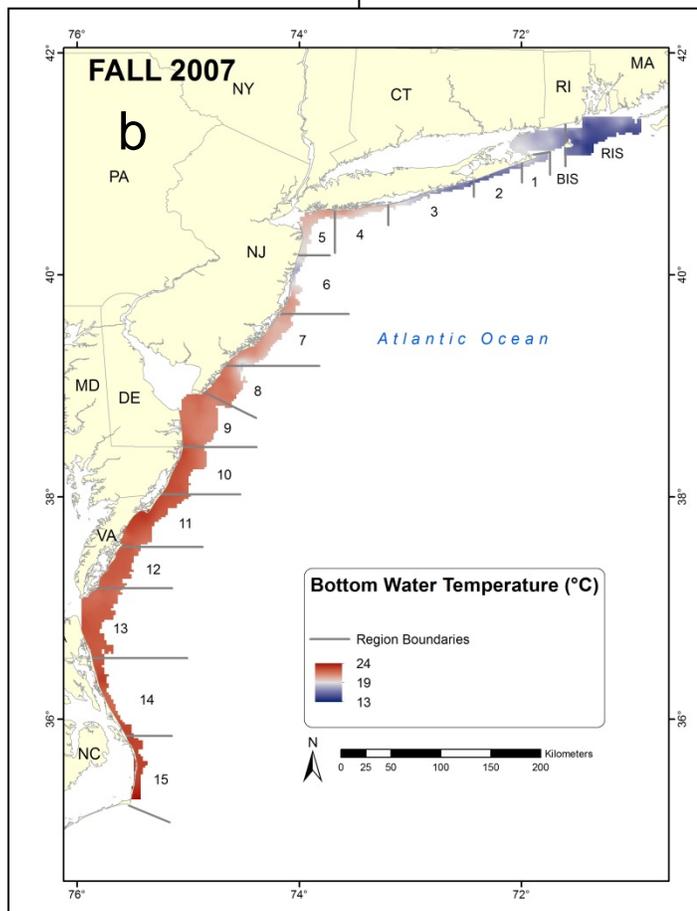
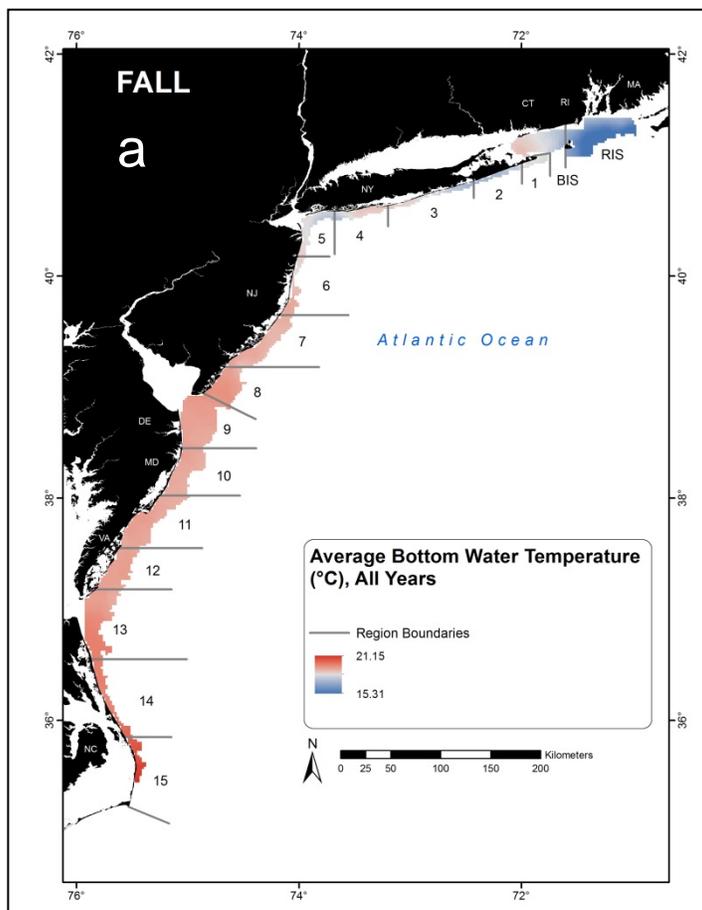


Figure 3H. Bottom temperatures as measured by NEAMAP for fall 2008. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2008, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

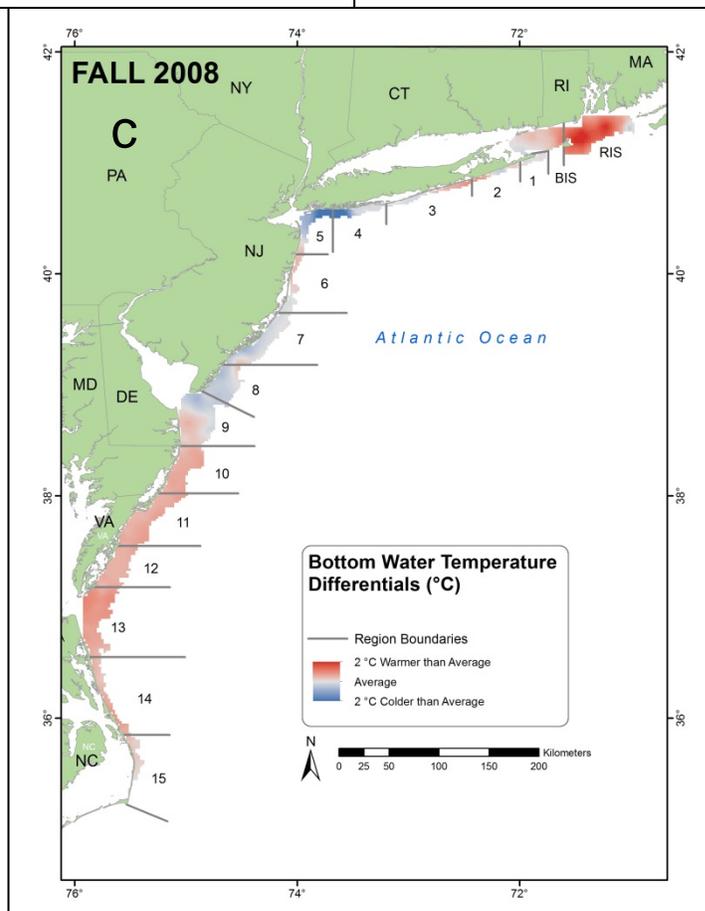
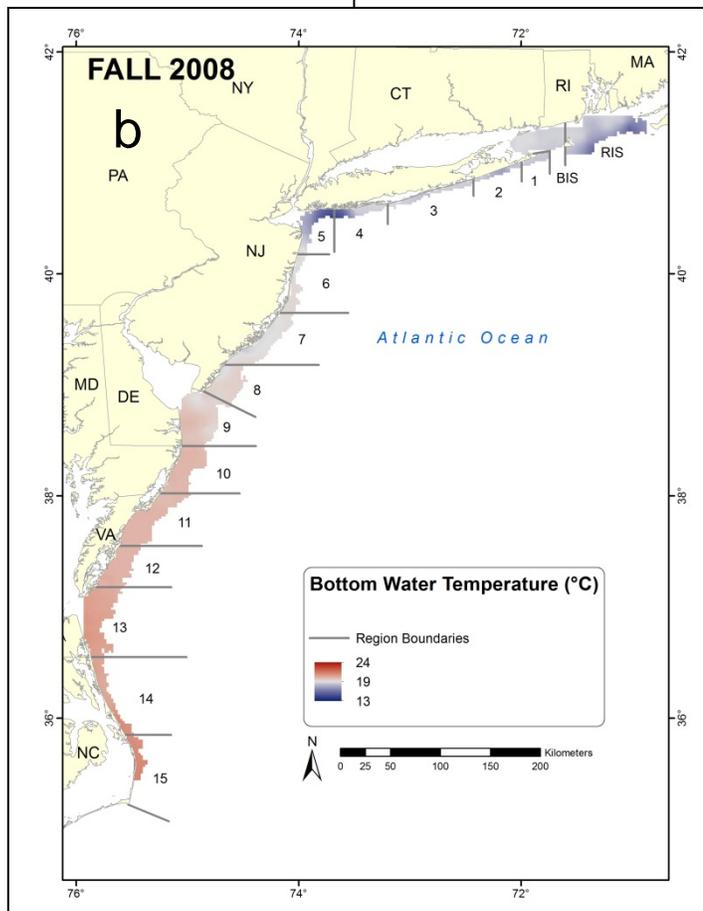
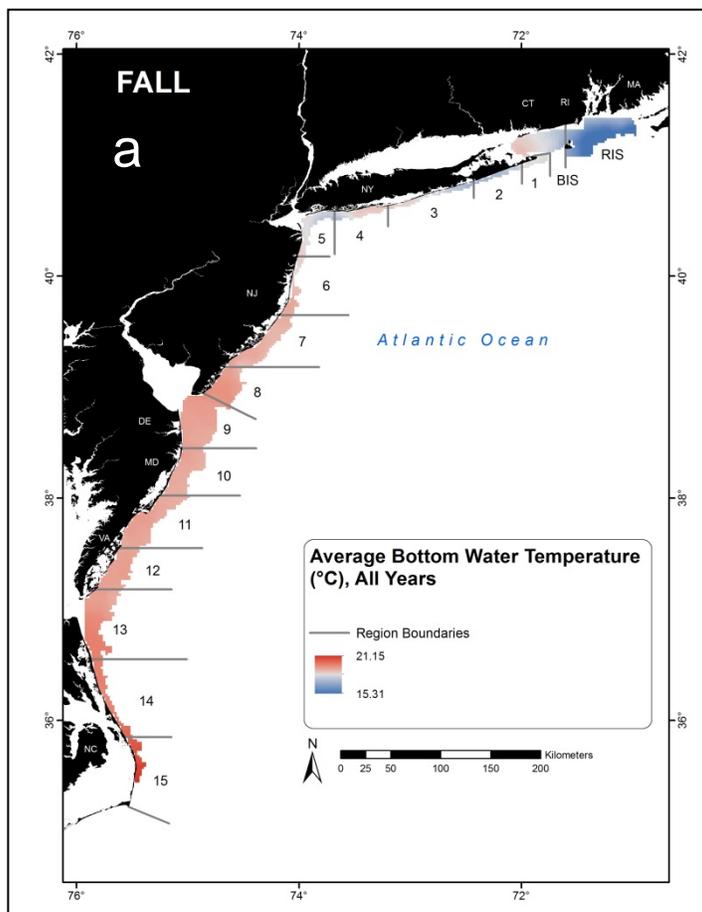


Figure 31. Bottom temperatures as measured by NEAMAP for fall 2009. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2009, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

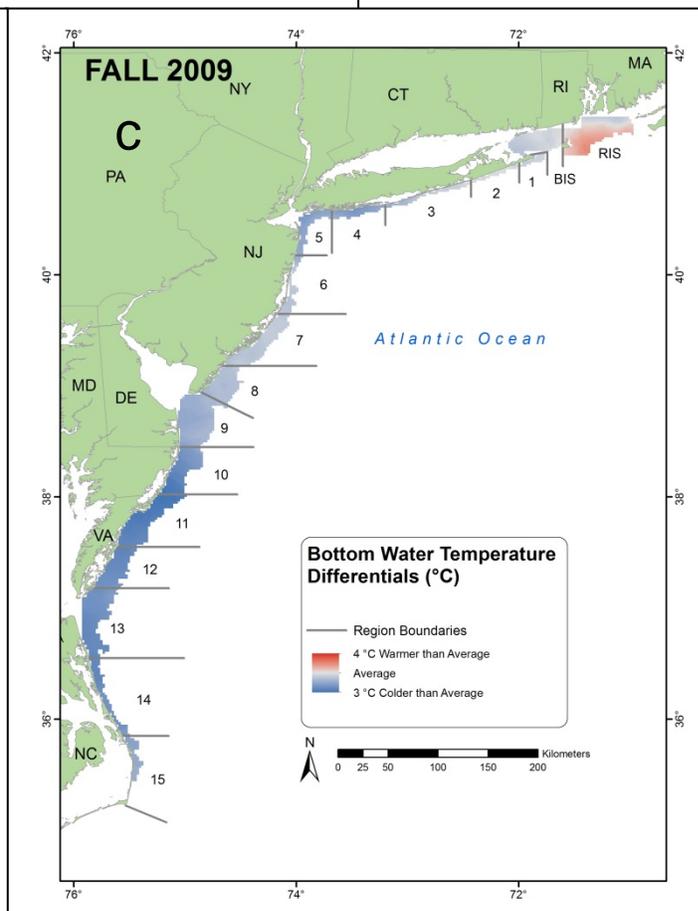
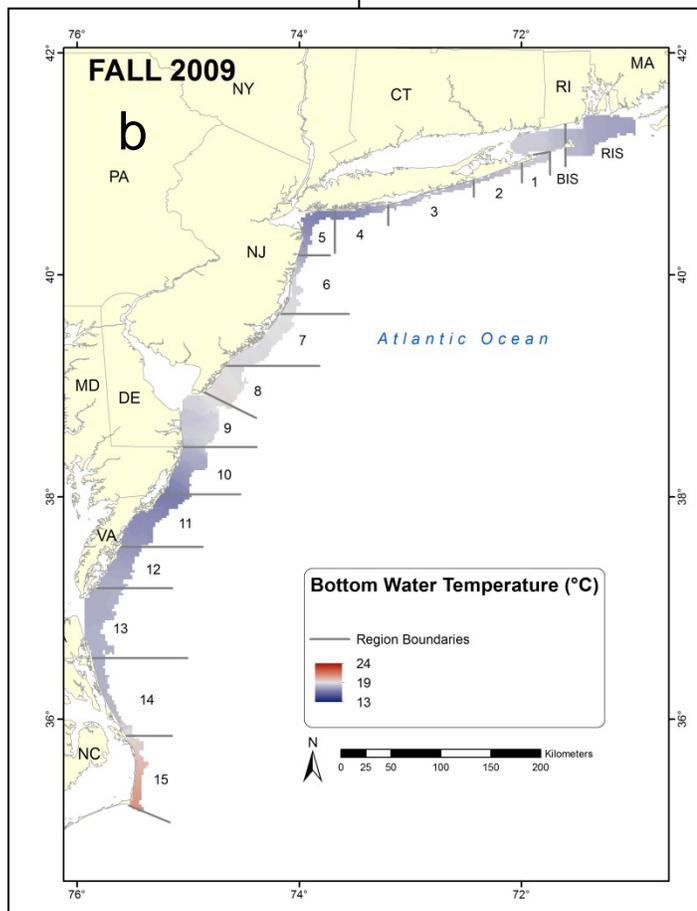
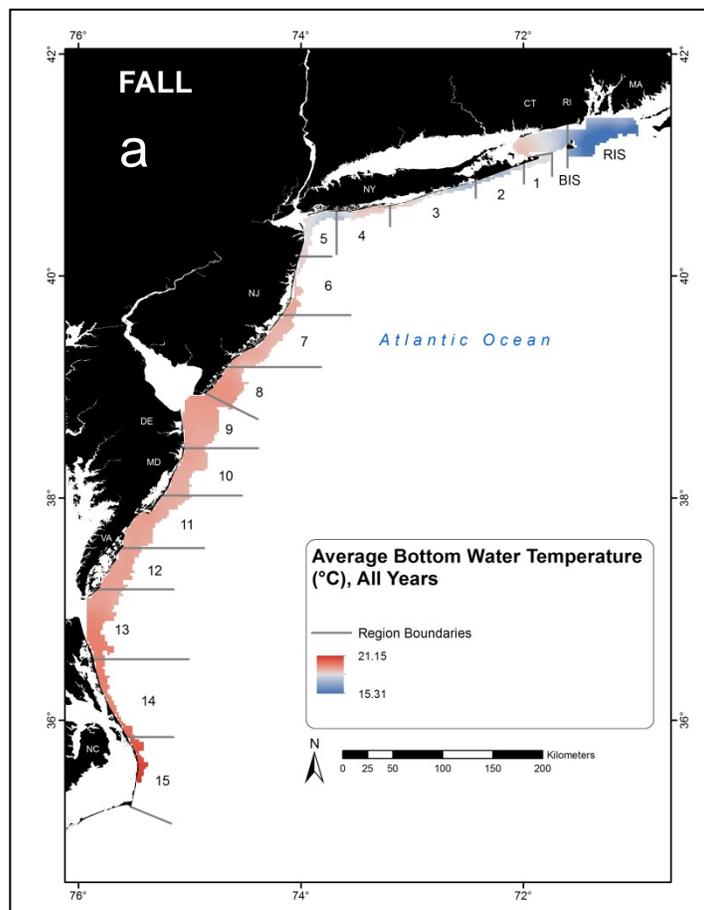


Figure 3J. Bottom temperatures as measured by NEAMAP for fall 2010. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2010, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

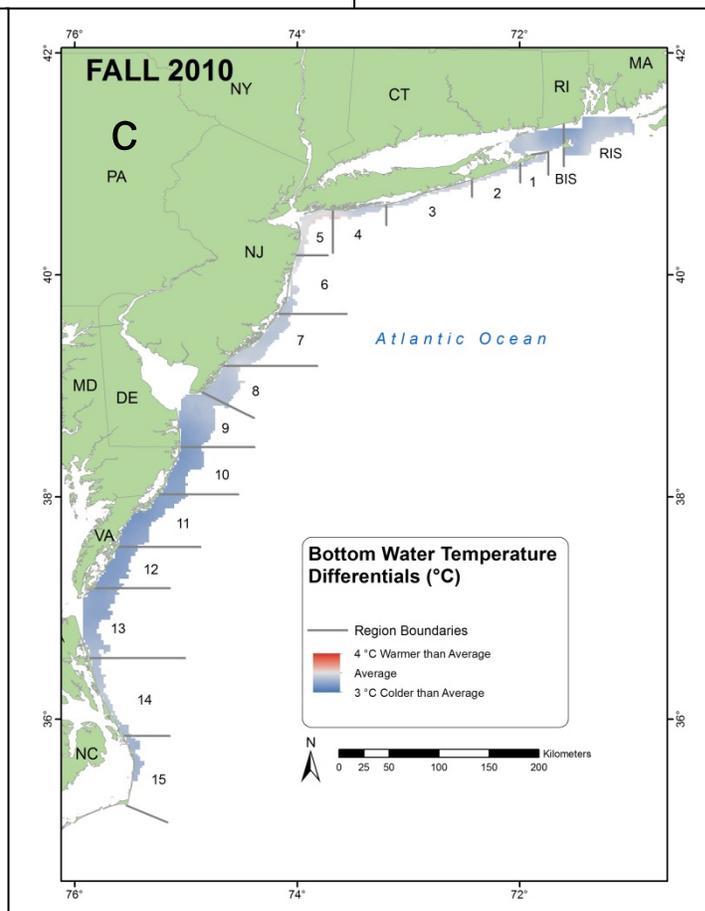
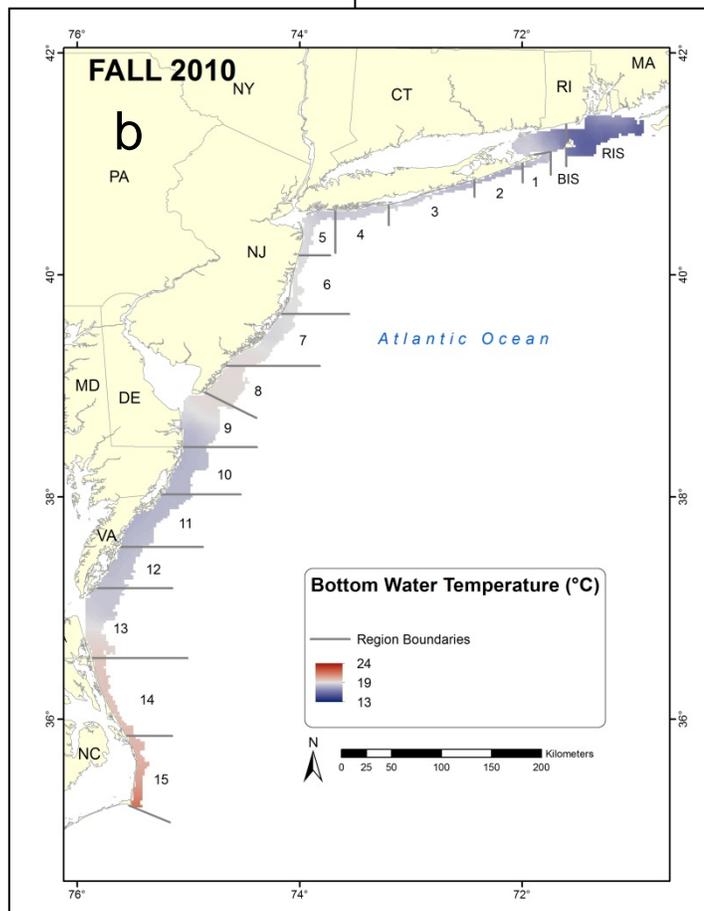
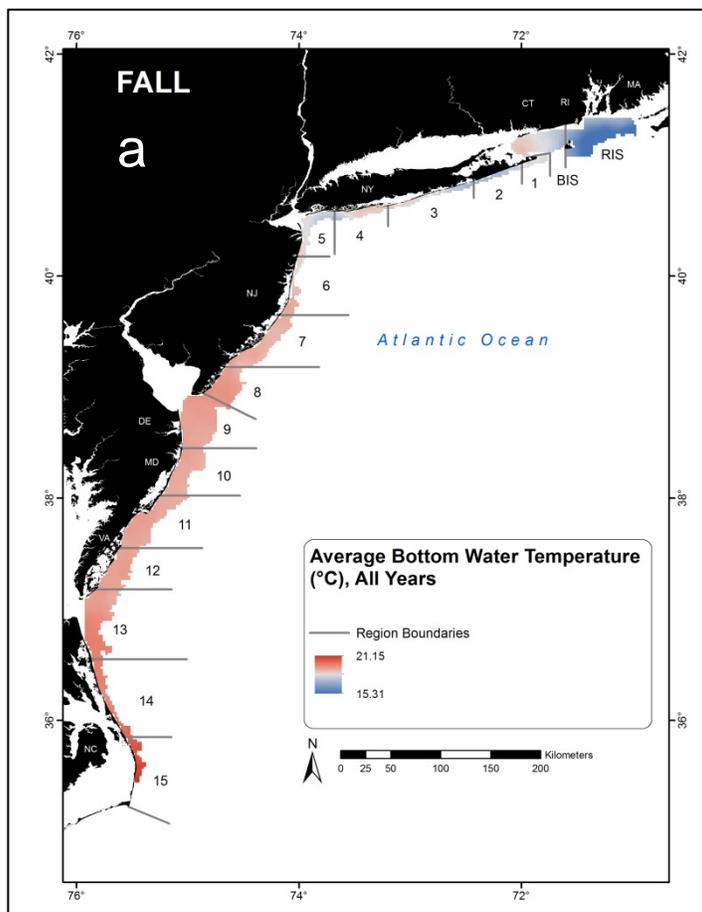


Figure 3K. Bottom temperatures as measured by NEAMAP for fall 2011. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2011, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

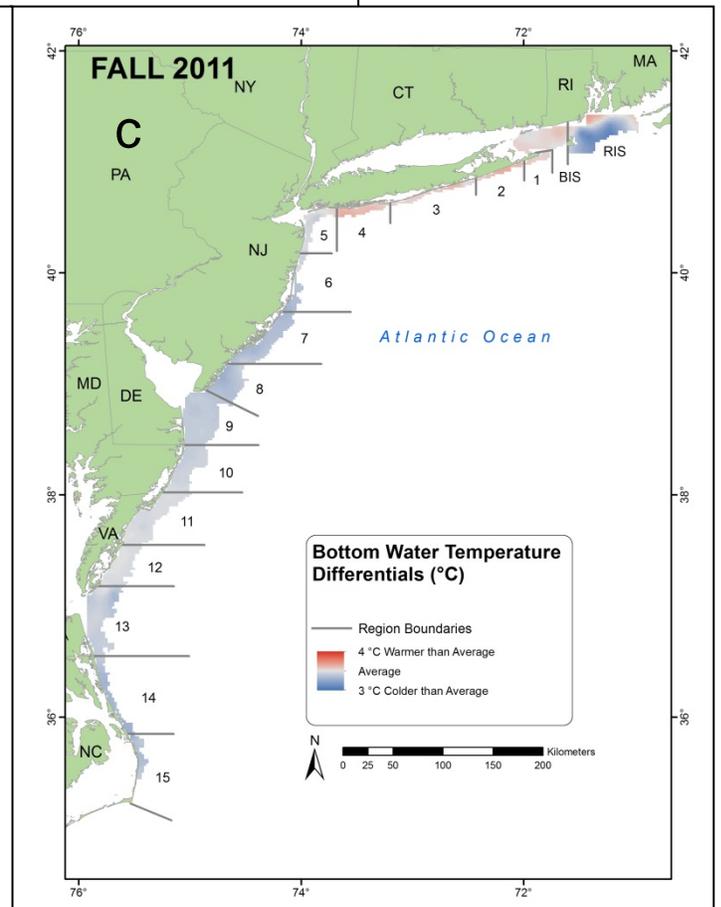
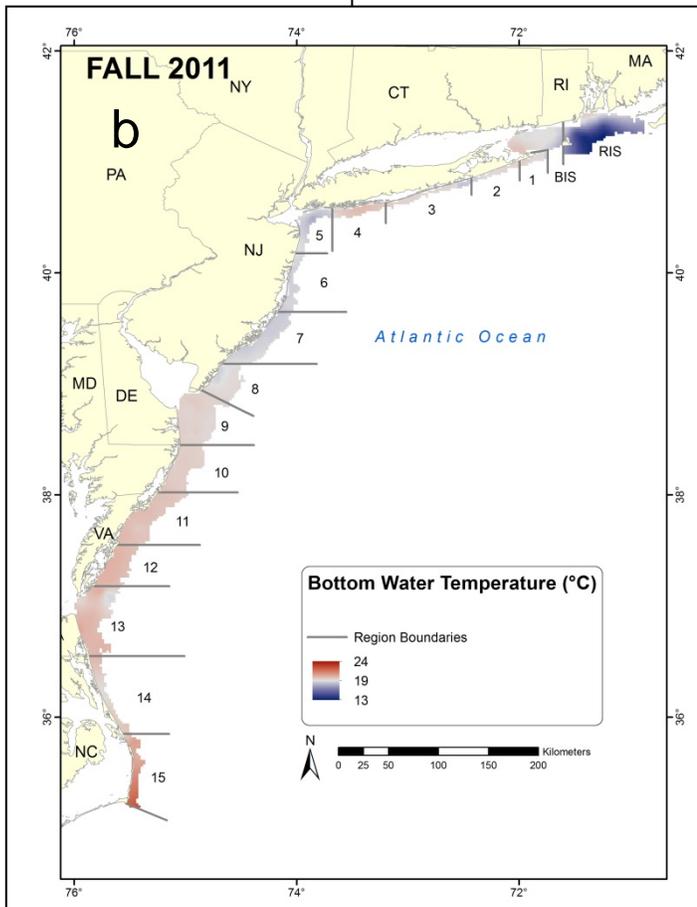
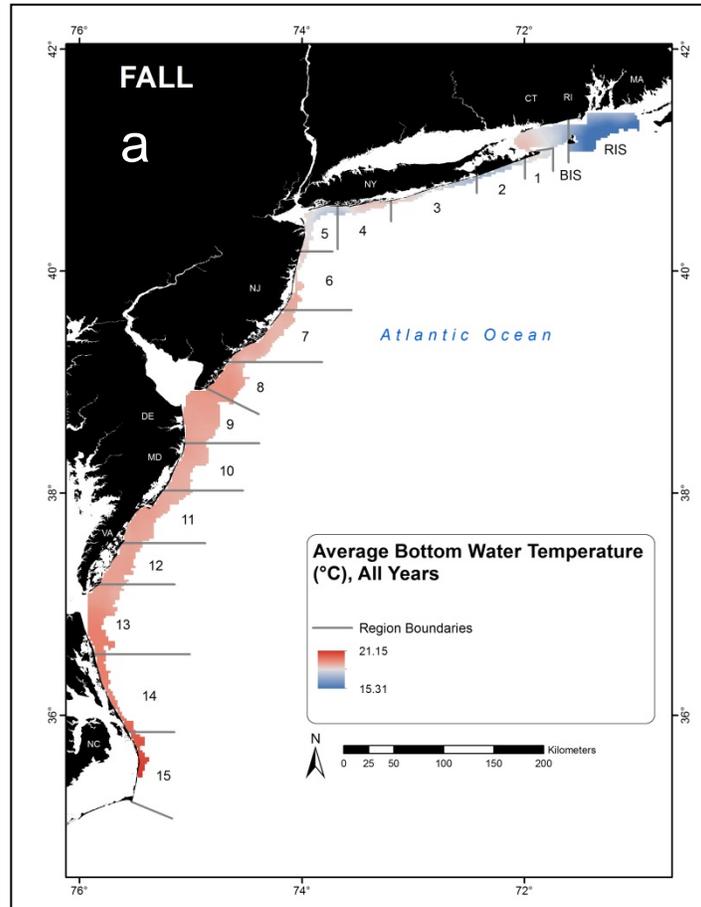


Figure 3L Bottom temperatures as measured by NEAMAP for fall 2012. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2012, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

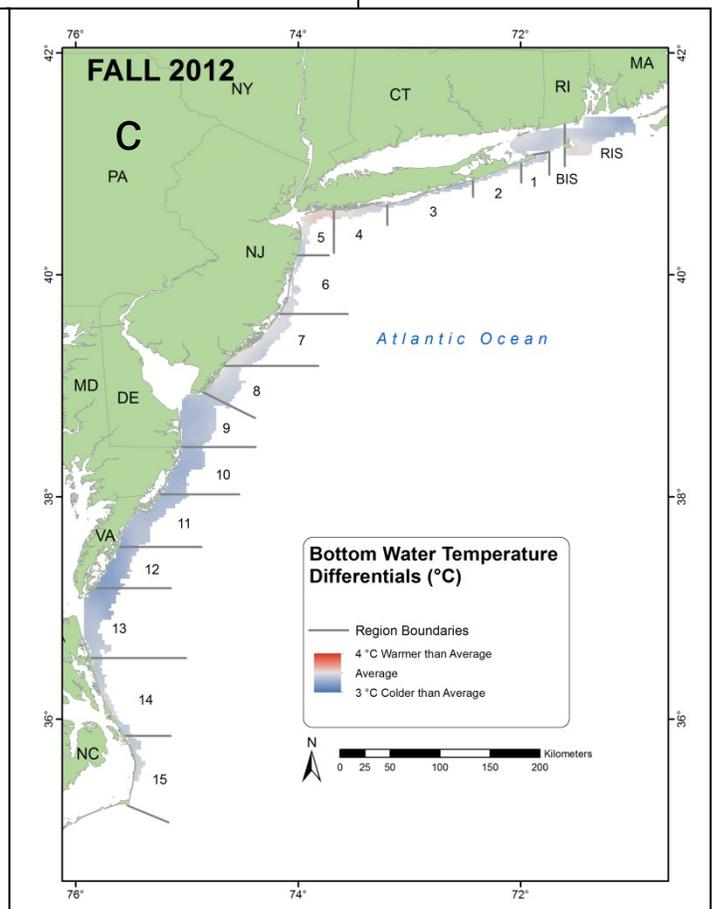
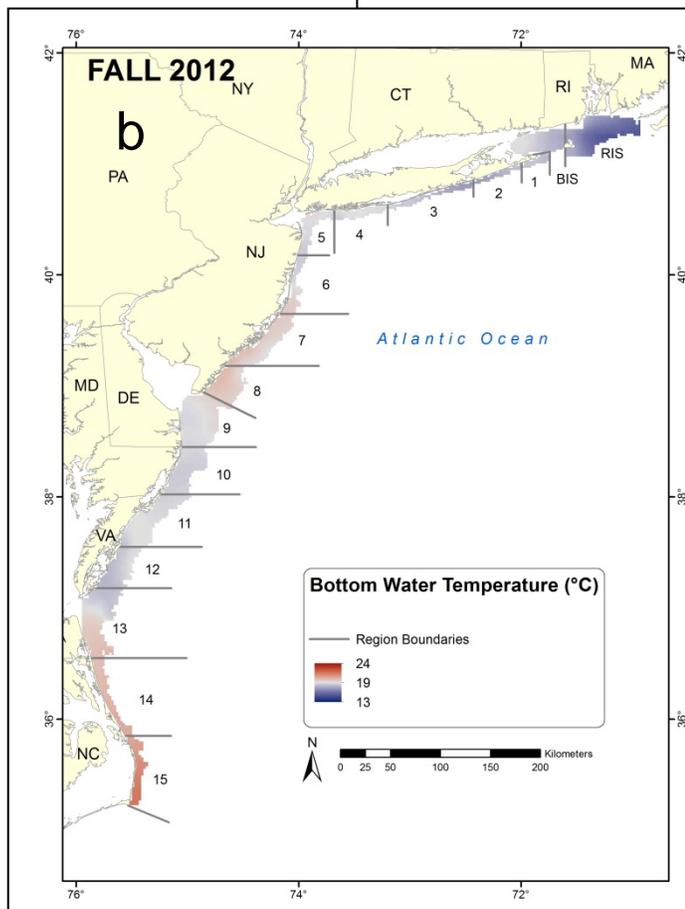
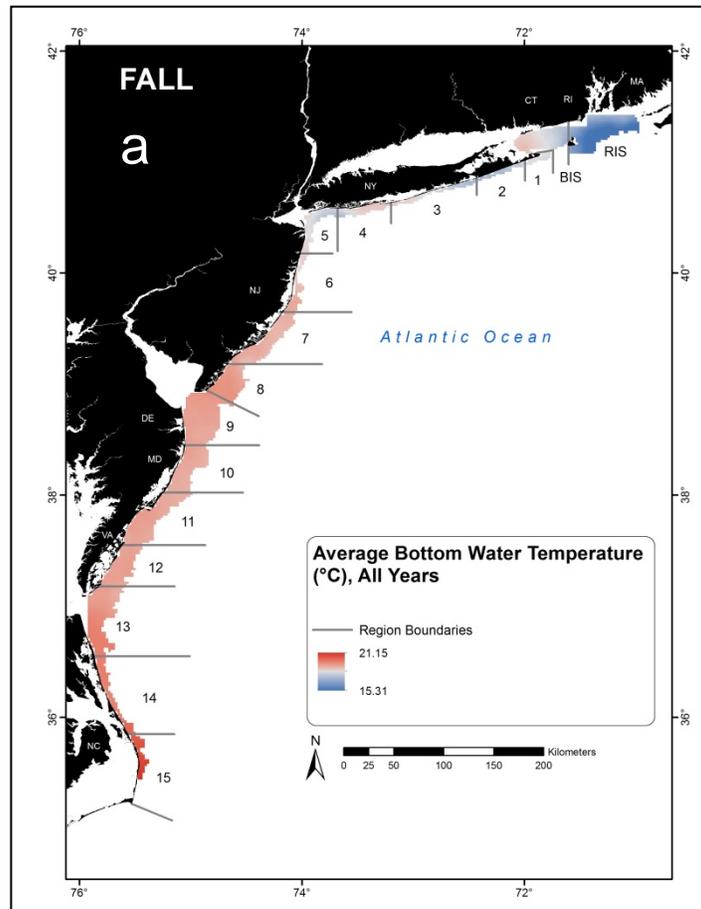


Figure 3M Bottom temperatures as measured by NEAMAP for fall 2013. (Map 'a' represents measured values averaged over all fall cruises, 'b' gives actual values for fall 2013, and 'c' represents the difference. Note that the color scheme and value ranges are the same for 'a' and 'b' which both differ from 'c'.)

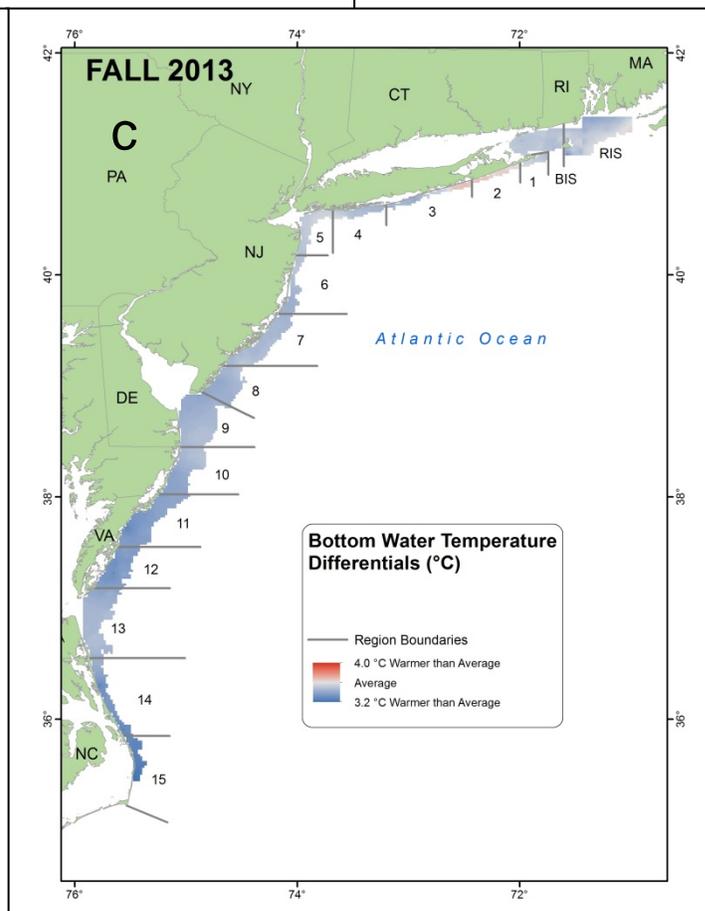
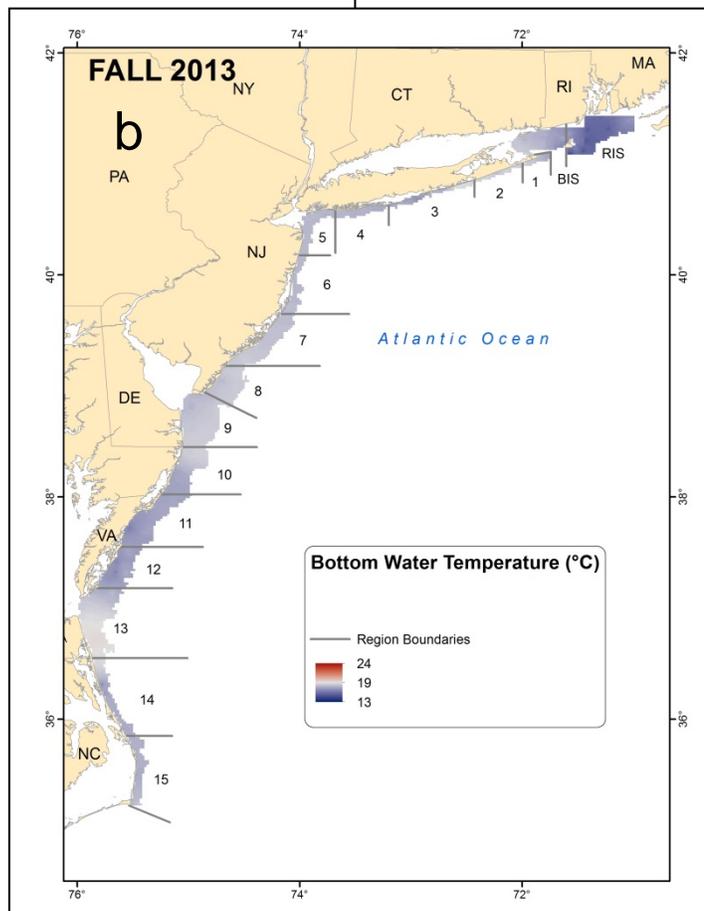
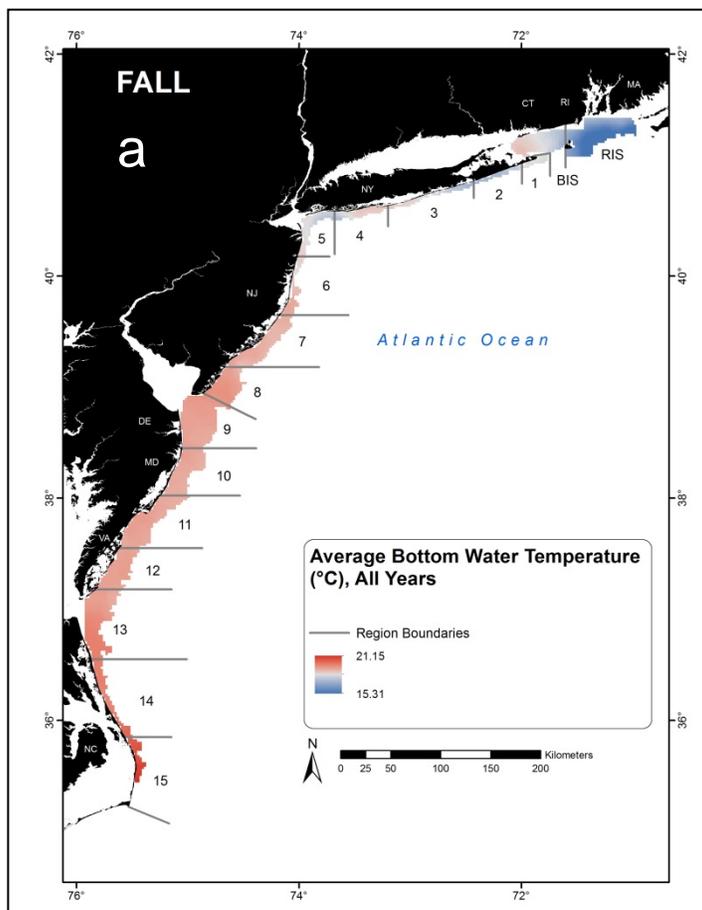


Figure 4. Water column temperature profiles integrated within defined 'section' boundaries for spring (A) and fall (B) 2013.

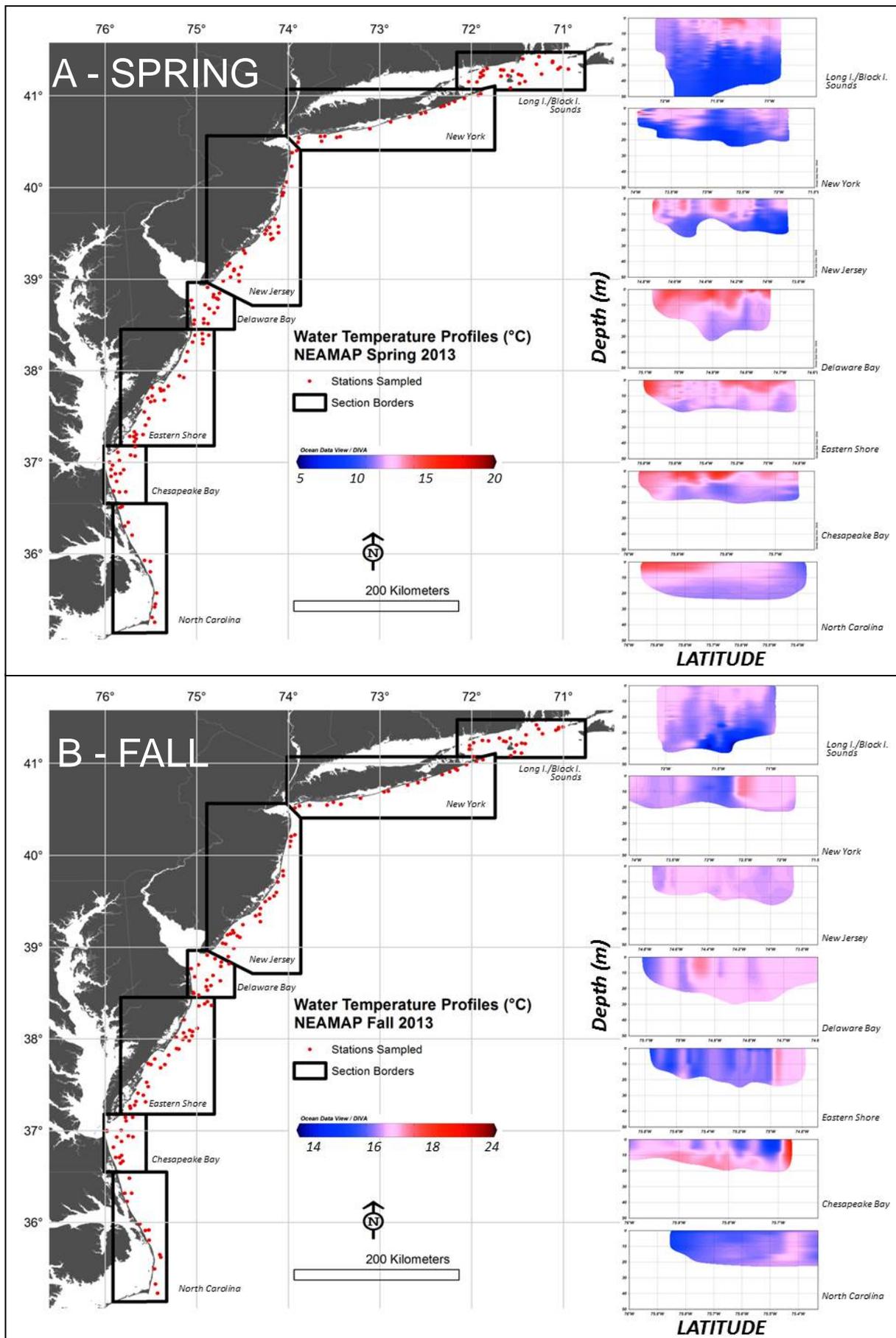
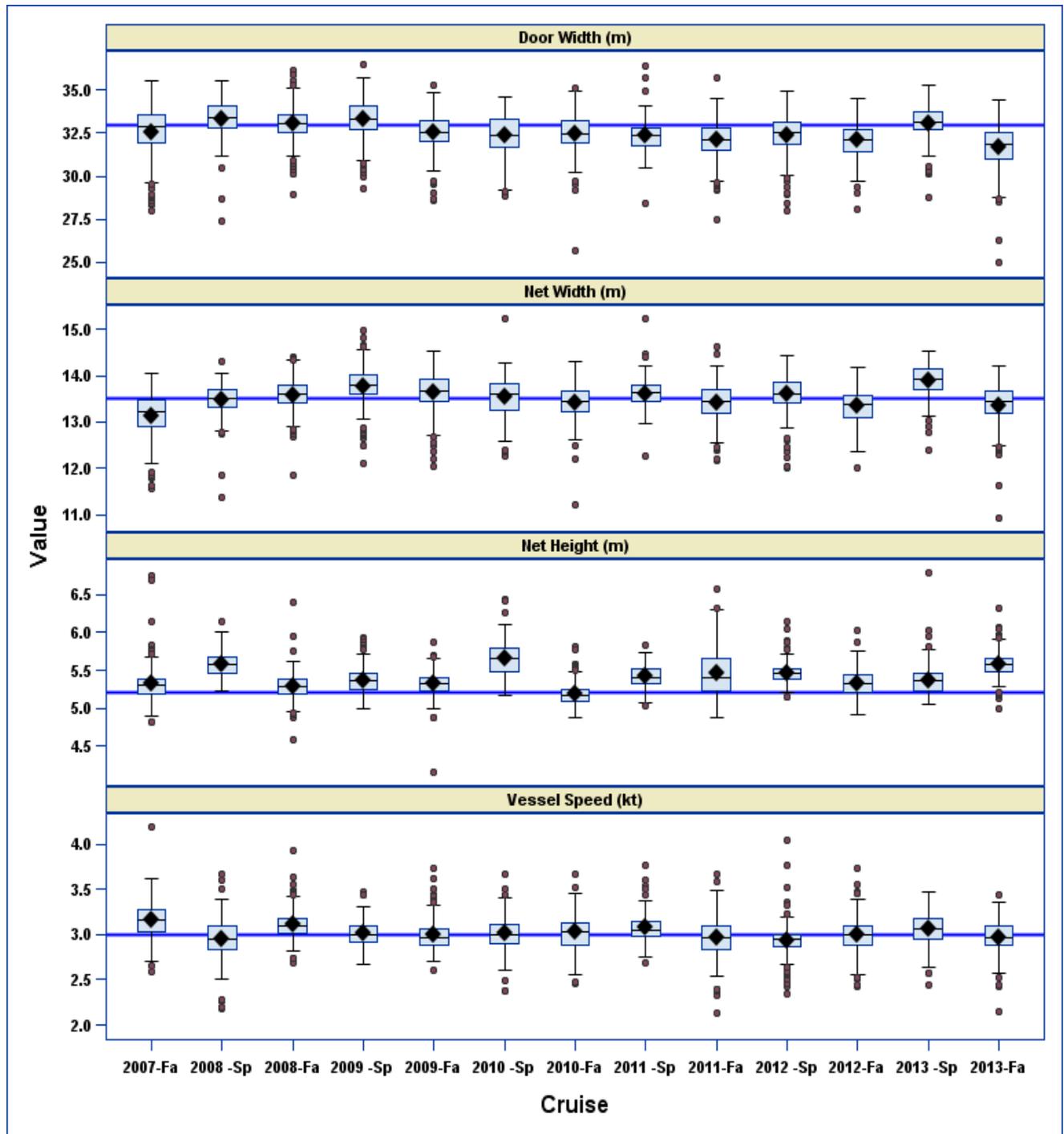


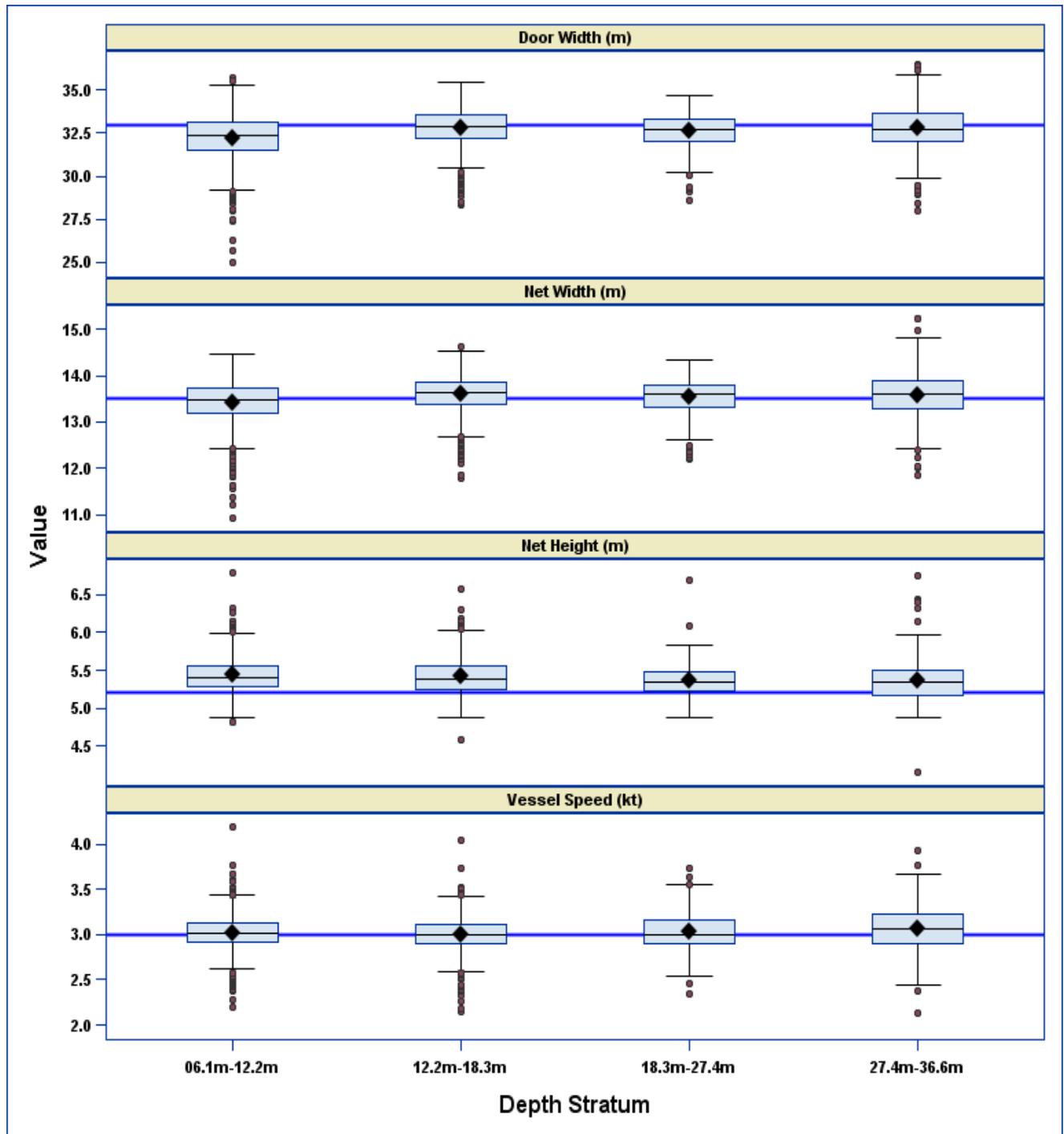
Figure 5A. Performance of the NEAMAP sampling gear for all tows during each research cruise, by cruise*.



* Explanation of the plot:

- Target values for each parameter are represented by the solid blue lines. Optimal door spreads are 32.0 m - 34.0 m, net widths (wing spread) are 13.0 m - 14.0m, headline heights are 5.0 m - 5.5 m. and vessel speeds over ground are 2.9kt - 3.3kt.
- Within each box the diamond represents the mean of all 150 tows and the horizontal line is the median.
- The boxes include the 25th through the 75th percentiles of all tows.
- Horizontal 'whiskers' represent the minimum and maximum values inside the 1.5 interquartile fence.
- Individual circles represent tows lying outside the 'min' and 'max' values above.

Figure 5B. Performance of the NEAMAP sampling gear for all tows during each research cruise, by depth stratum*.



* Explanation of the plot:

- Target values for each parameter are represented by the solid blue lines. Optimal door spreads are 32.0 m - 34.0 m, net widths (wing spread) are 13.0 m - 14.0m, headline heights are 5.0 m - 5.5 m. and vessel speeds over ground are 2.9kt - 3.3kt.
- Within each box the diamond represents the mean of all 150 tows and the horizontal line is the median.
- The boxes include the 25th through the 75th percentiles of all tows.
- Horizontal 'whiskers' represent the minimum and maximum values inside the 1.5 interquartile fence.
- Individual circles represent tows lying outside the 'min' and 'max' values above.

Figure 6A. Catch history for non-index species of interest or concern, Atlantic sturgeon.

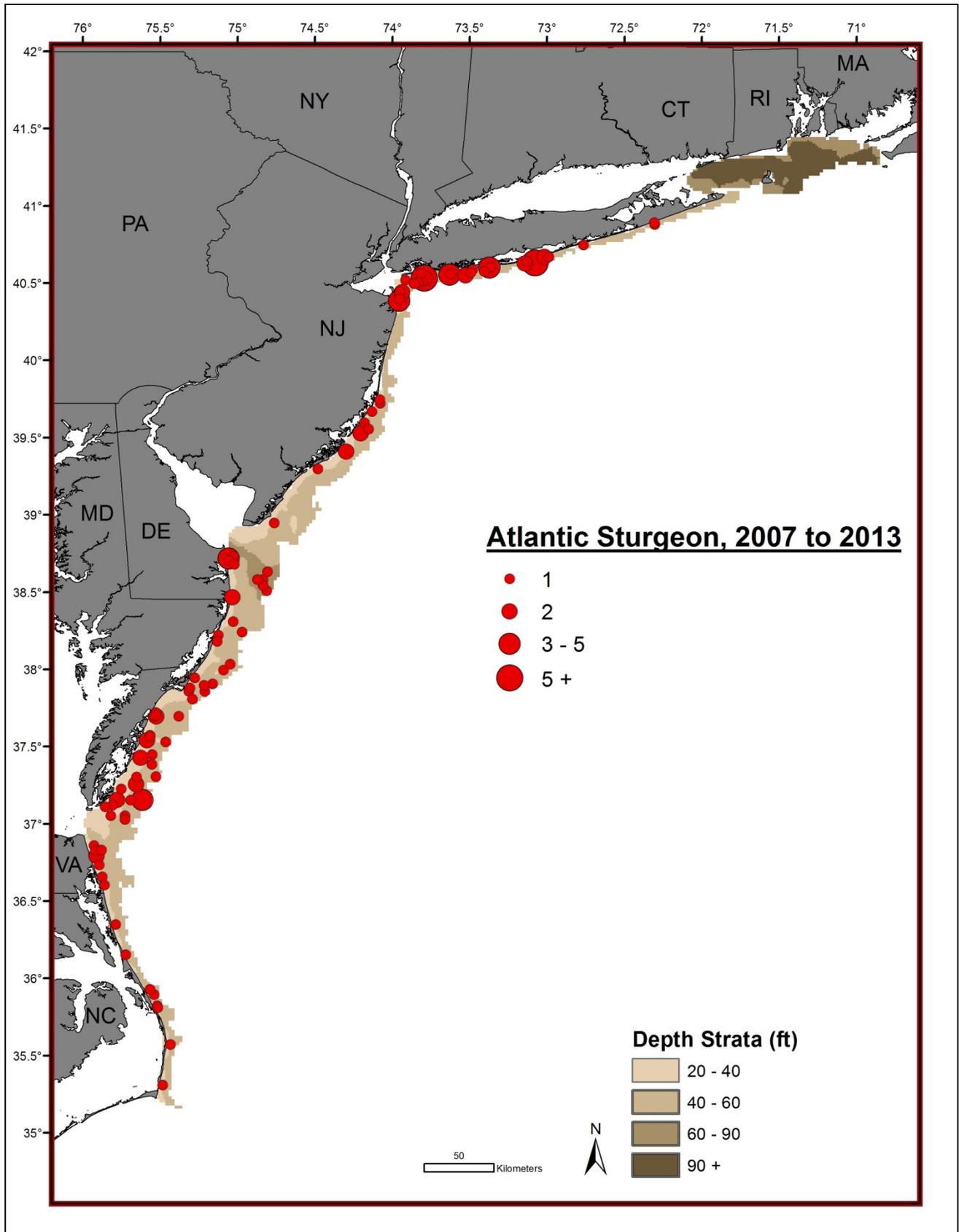


Figure 6B. Catch history for non-index species of interest or concern, sea turtles.

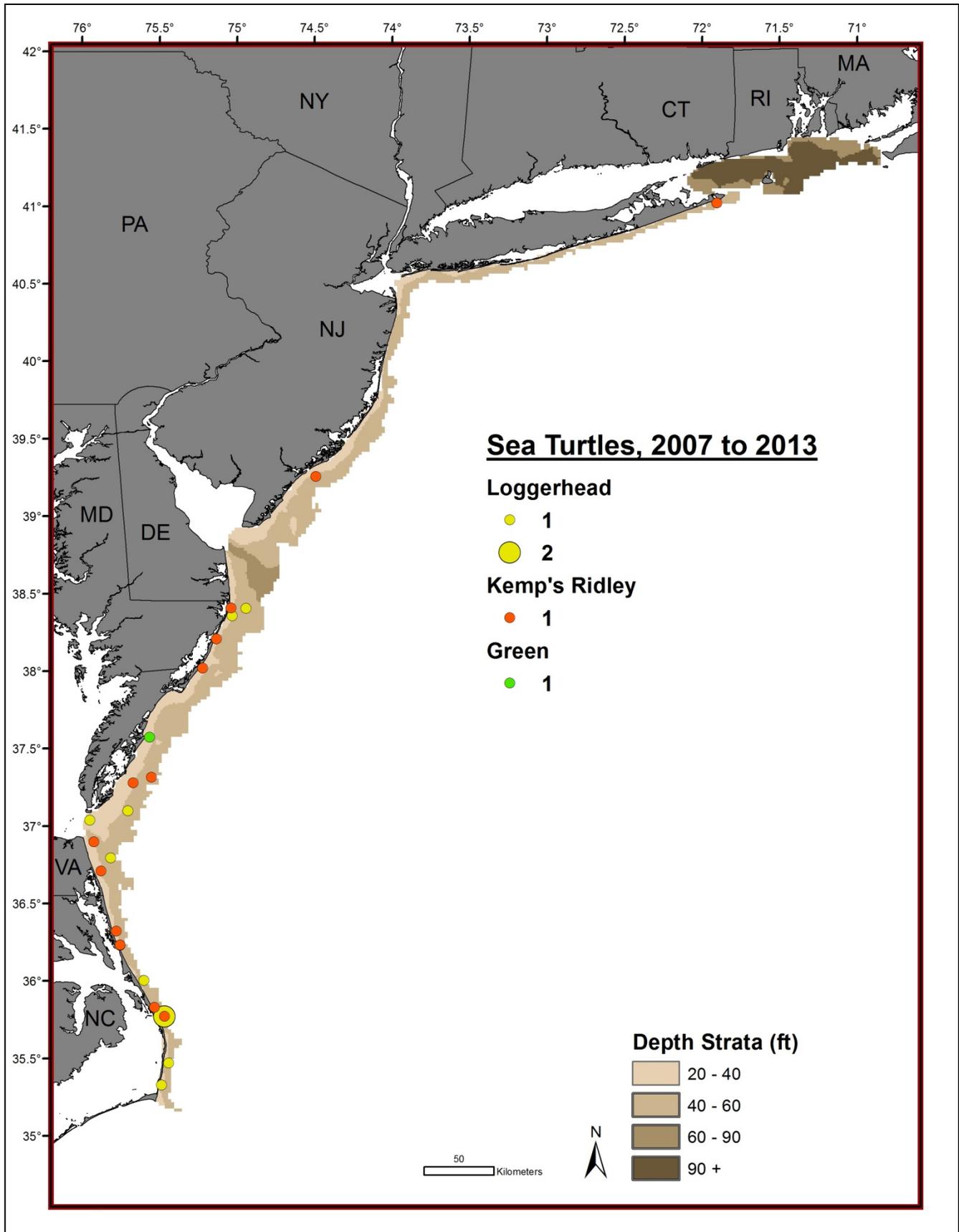


Figure 6C. Catch history for non-index species of interest or concern, coastal sharks.

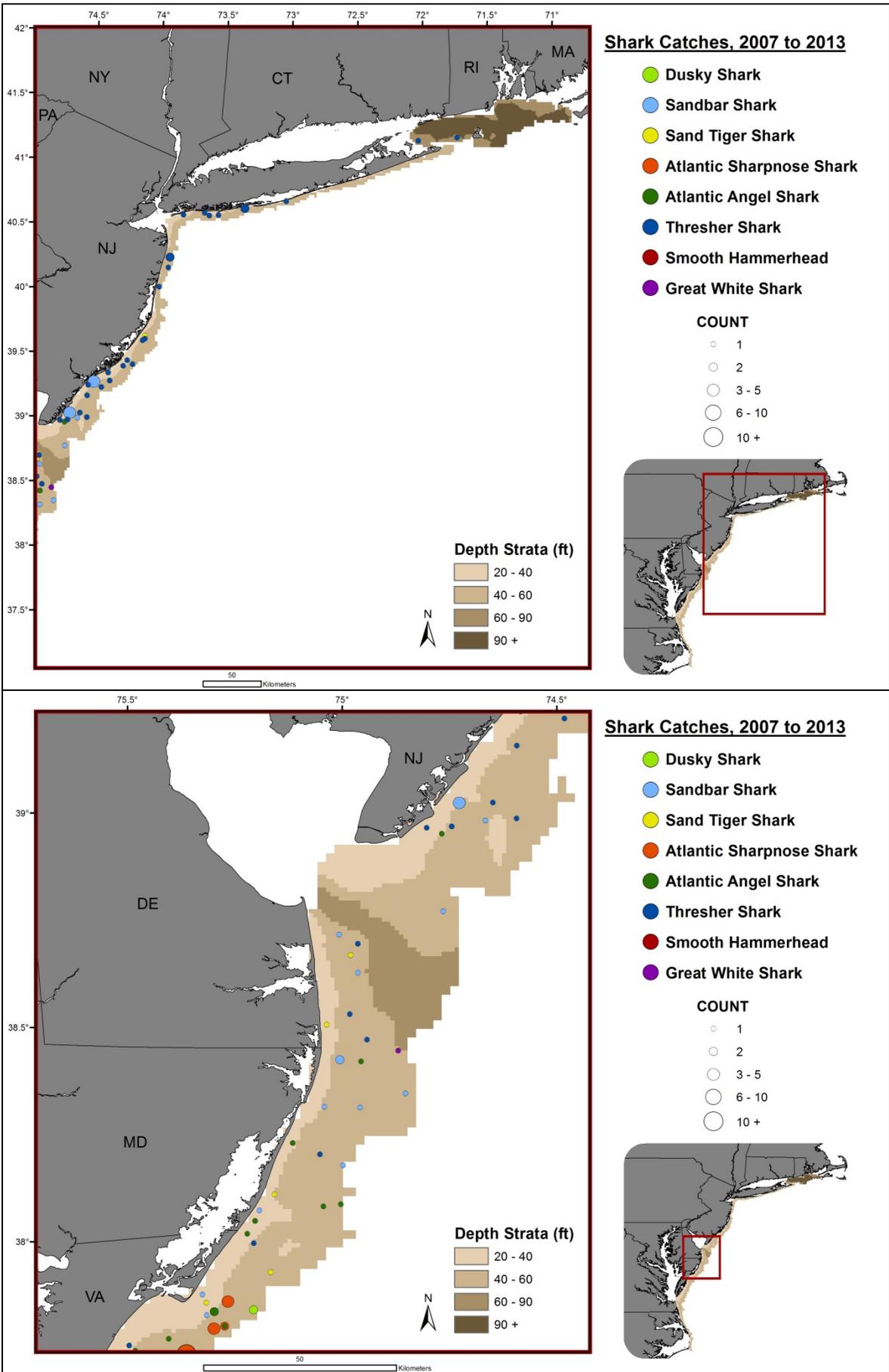
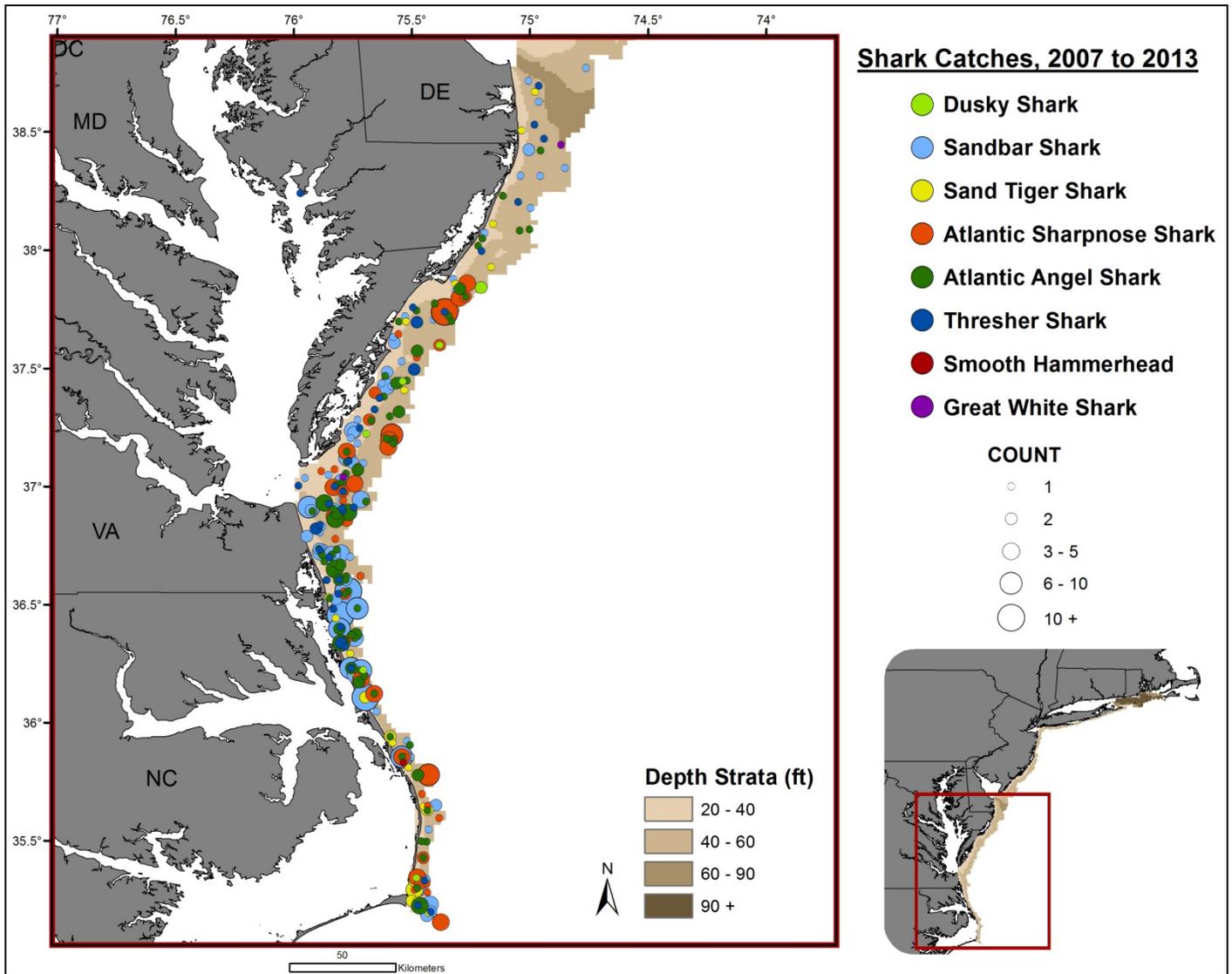


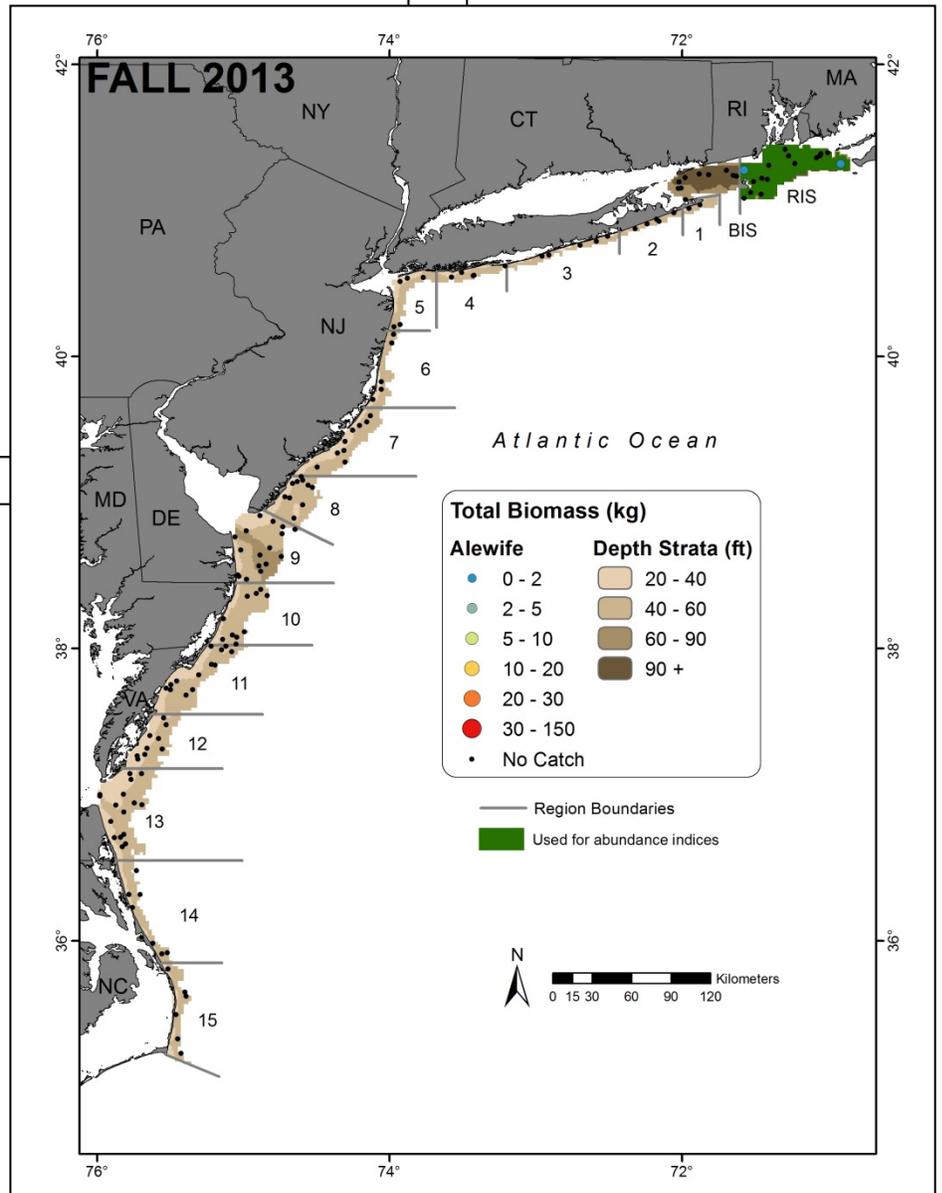
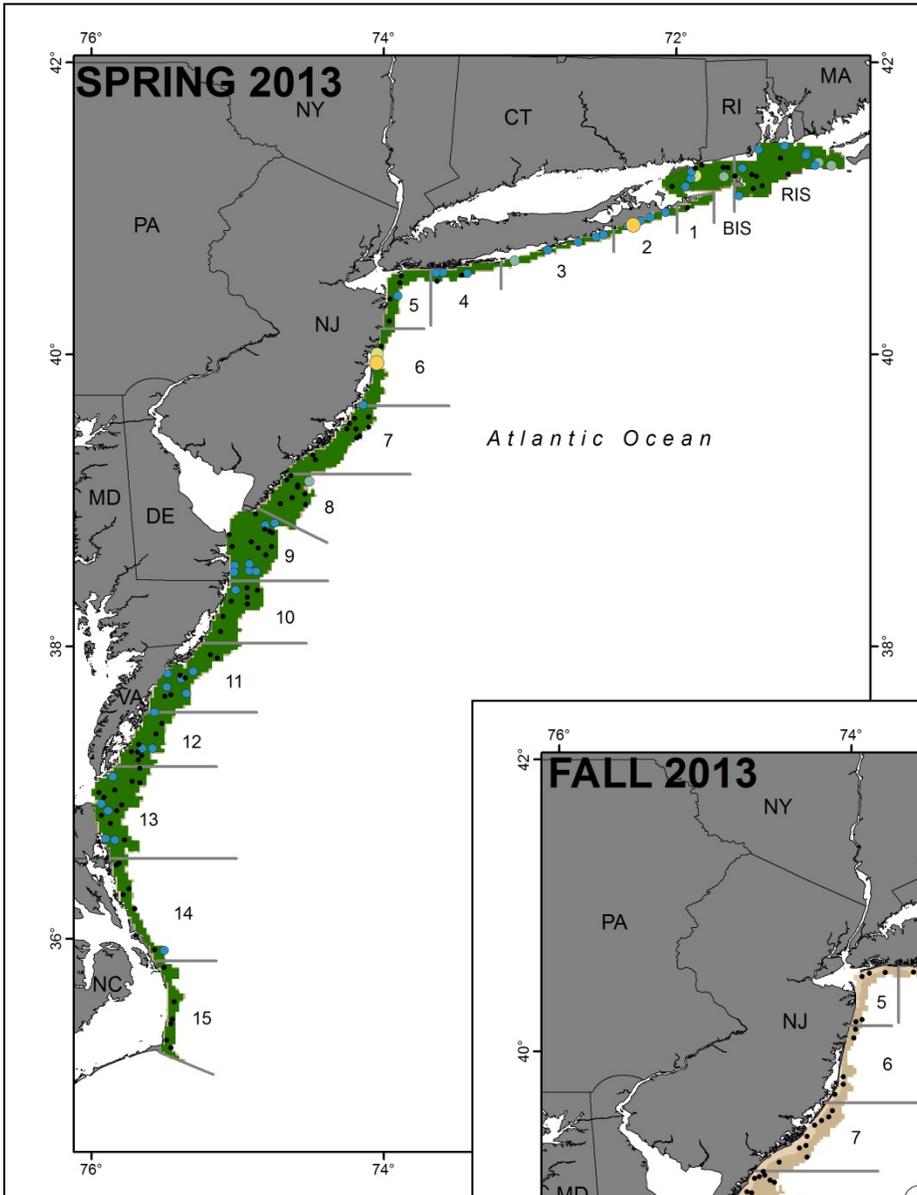
Figure 6C. continued.



Alewife

Sampling Priority: A

Figure 7. Alewife biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
VA	11	40-60		
		20-40		
		40-60		
NC	12	20-40		
		40-60		
		20-40		
	13	40-60		
NC	14	20-40		
		40-60		
		20-40		
	15	40-60		

= used for abundance indices
 = not used for abundance indices

Table 7. Alewife sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	2,419	141.8	1,572	350	0	344	5
	2009	2,955	233.0	1,225	235	0	235	4
	2010	3,735	209.7	1,547	273	0	270	21
	2011	3,373	154.1	1,828	323	0	314	309
	2012	2,955	92.9	1,839	209	0	186	182
	2013	1,368	73.1	1,137	213	0	207	201
Fall	2007	56	3.1	56	24	0	24	0
	2008	5	0.3	5	5	0	5	0
	2009	87	3.9	87	17	0	16	16
	2010	565	13.7	360	39	0	38	38
	2011	27	1.2	27	13	0	13	11
	2012	57	3.6	57	19	0	15	15
	2013	2	0.1	2	2	0	1	0

Table 8. Alewife geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured .

Spring Survey							Fall Survey										
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	17	0.06	0.62	1.47	0.00	0.10	0.25
	2008	150	1.58	2.15	2.85	0.25	0.37	0.49	2008	16		0.00	0.06	0.19	0.00	0.01	0.02
	2009	160	0.80	1.15	1.58	0.14	0.25	0.37	2009	16		0.00	0.36	1.31	0.00	0.10	0.34
	2010	150	0.94	1.42	2.01	0.15	0.27	0.40	2010	16		1.37	5.68	17.83	0.11	0.50	1.01
	2011	150	1.31	1.86	2.54	0.21	0.32	0.43	2011	16		0.00	0.39	1.14	0.00	0.06	0.15
	2012	150	0.76	1.13	1.57	0.14	0.23	0.33	2012	16		0.00	0.50	1.44	0.00	0.10	0.29
	2013	150	0.54	0.80	1.10	0.09	0.15	0.22	2013	16		0.00	0.11	0.28	0.00	0.01	0.03
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	17	0.00	0.00	0.00	0.00	0.00	0.00
	2008								2008	16		0.00	0.00	0.00	0.00	0.00	0.00
	2009								2009	16		0.00	0.09	0.23	0.00	0.01	0.01
	2010								2010	16		0.98	4.70	15.36	0.09	0.45	0.93
	2011								2011	16		0.00	0.23	0.70	0.00	0.03	0.09
	2012								2012	16		0.00	0.00	0.00	0.00	0.00	0.00
	2013								2013	16		0.00	0.00	0.00	0.00	0.00	0.00
	2014								2014								
2015								2015									
2016								2016									
1	2007																
	2008	150	0.87	1.22	1.65	0.10	0.17	0.24									
	2009	160	0.47	0.70	0.96	0.07	0.12	0.17									
	2010	150	0.71	1.07	1.52	0.09	0.17	0.26									
	2011	150	0.84	1.25	1.75	0.11	0.18	0.26									
	2012	150	0.49	0.82	1.23	0.06	0.15	0.24									
	2013	150	0.32	0.50	0.71	0.03	0.07	0.11									
	2014																
2015																	
2016																	

Figure 8. Alewife geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

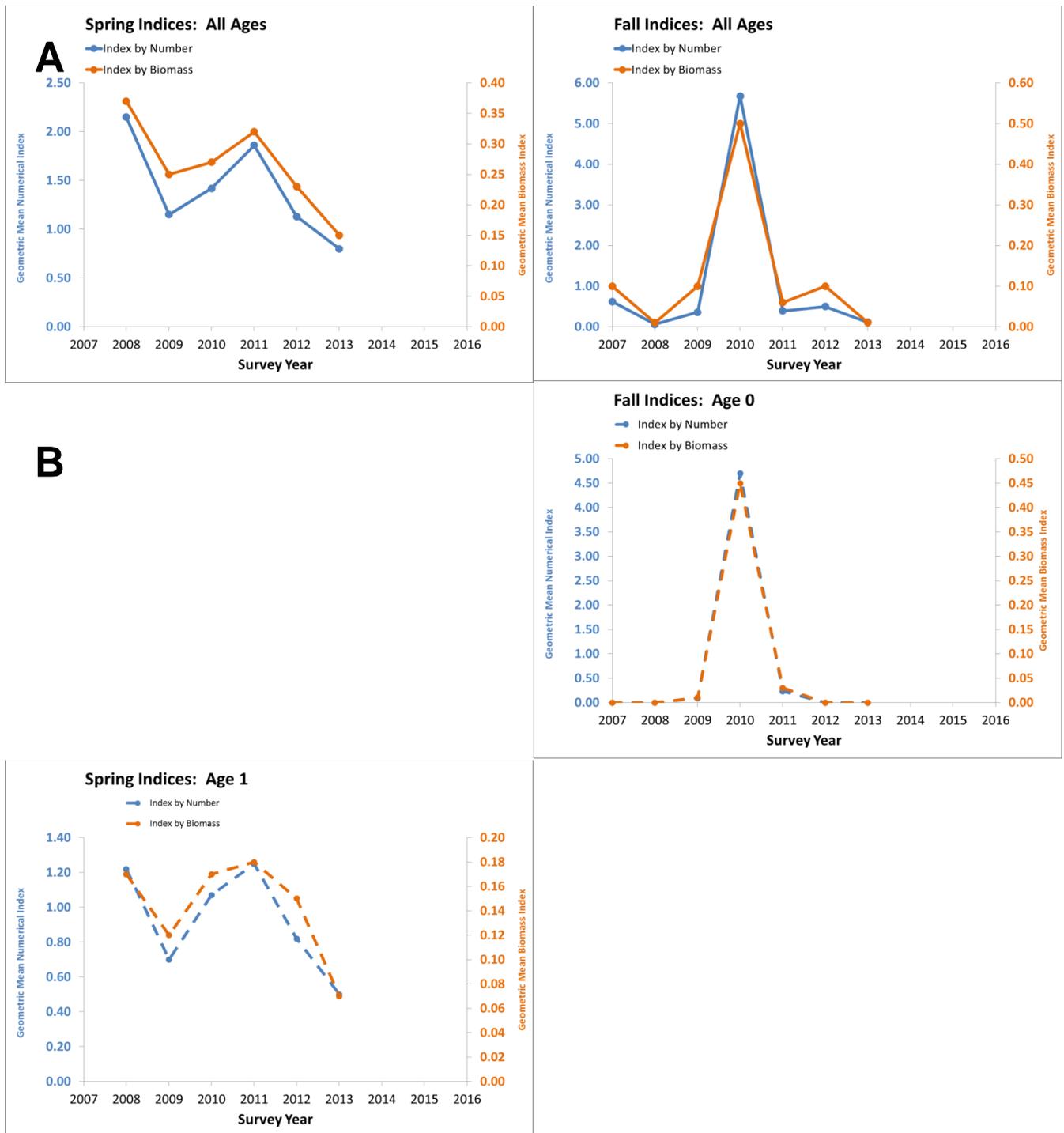


Figure 9. Alewife length-frequency distributions, by cruise (Blue reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values - spring 16cm, fall 14cm - estimated by examination of these length frequency figures.).

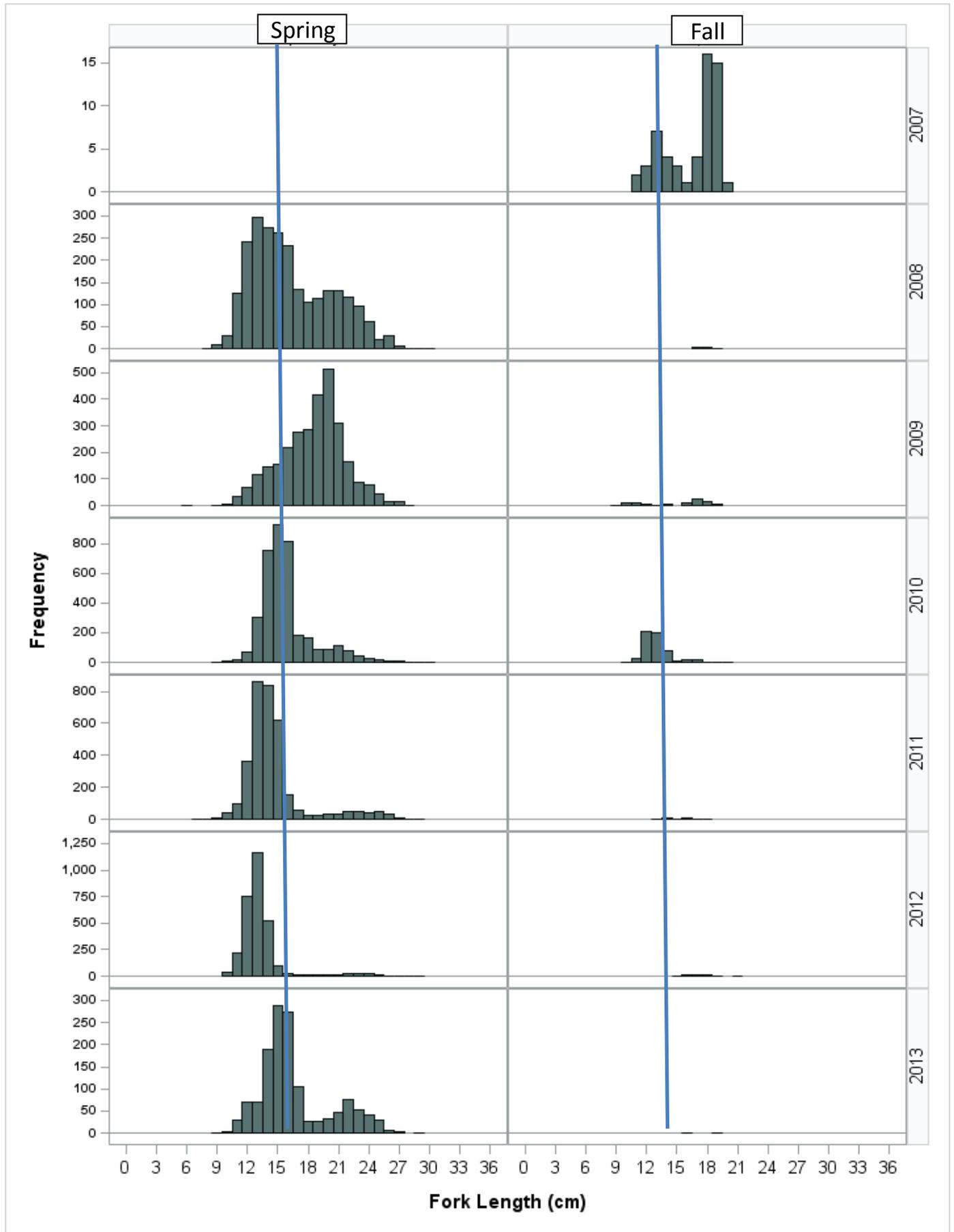


Figure 10. Alewife sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

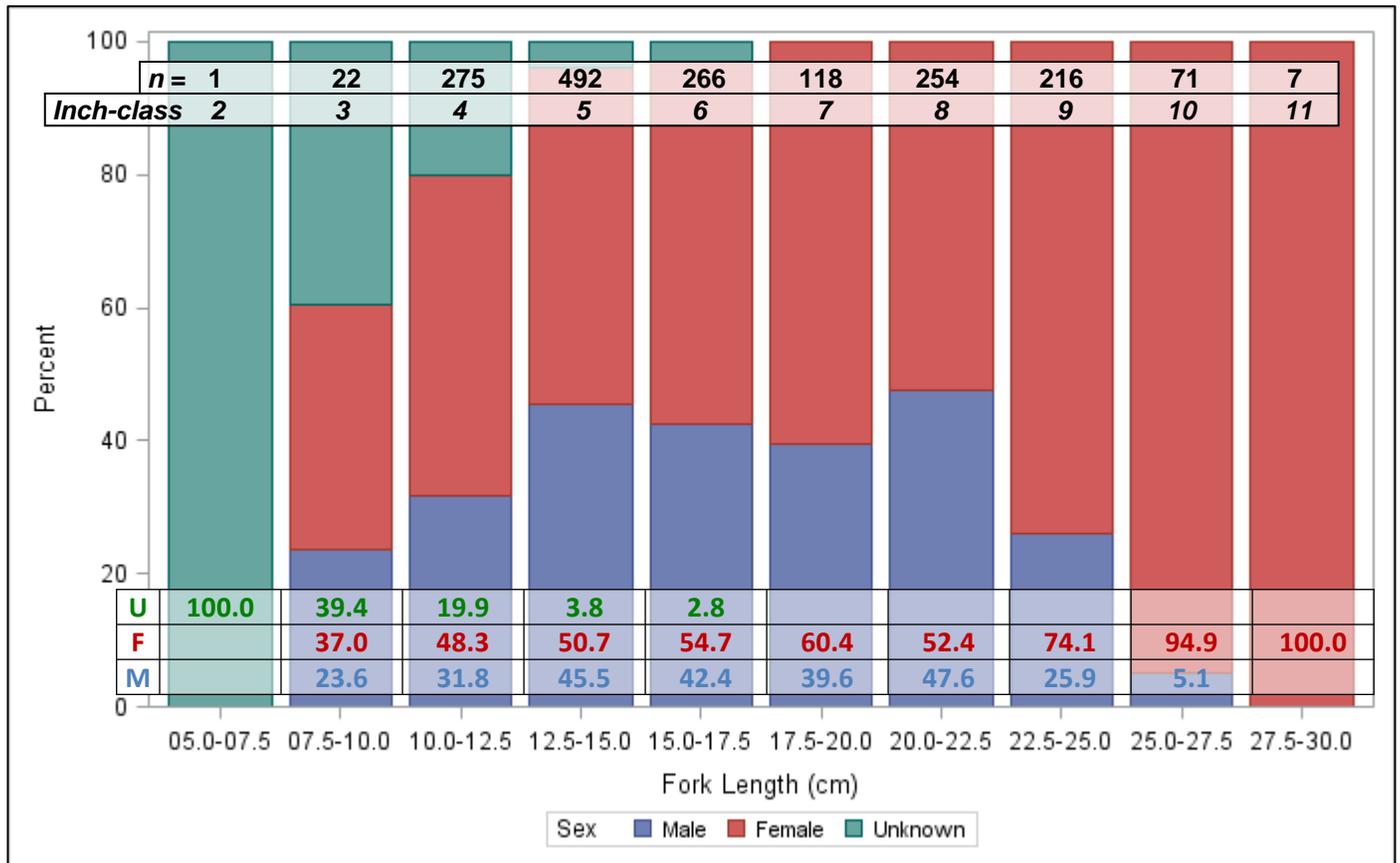


Figure 11. Alewife maturity at length, by sex for all cruises pooled, 2007-2013.

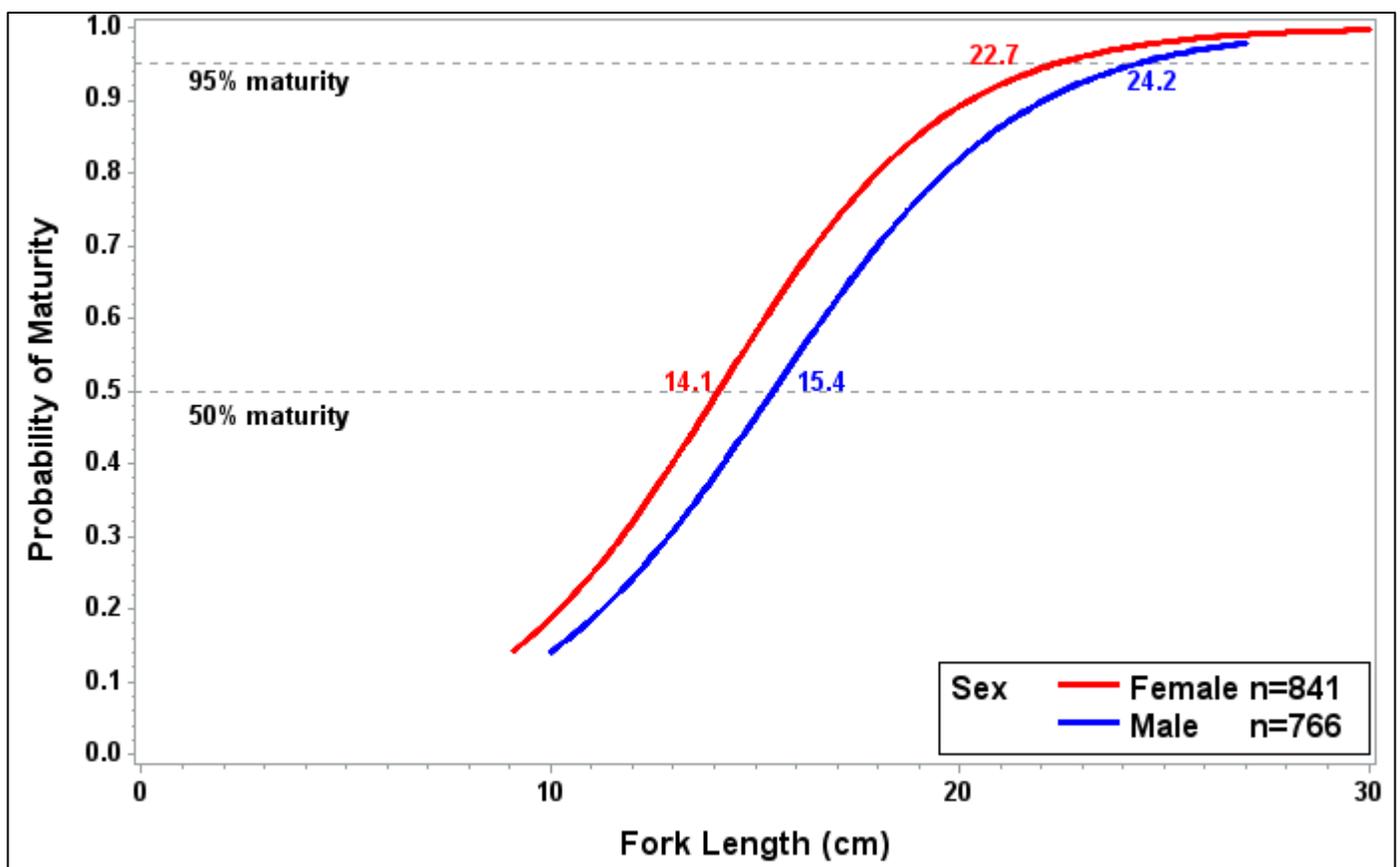
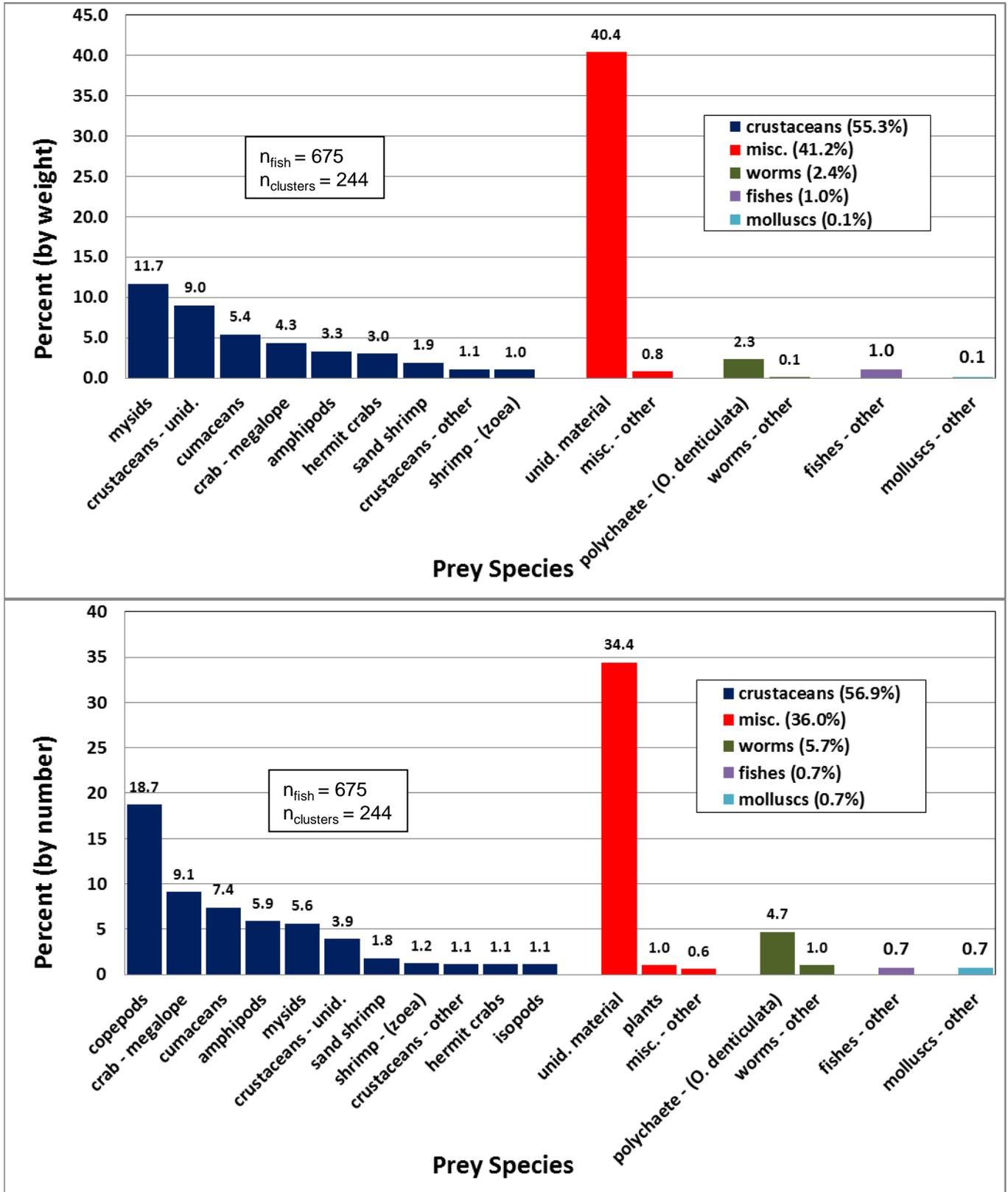


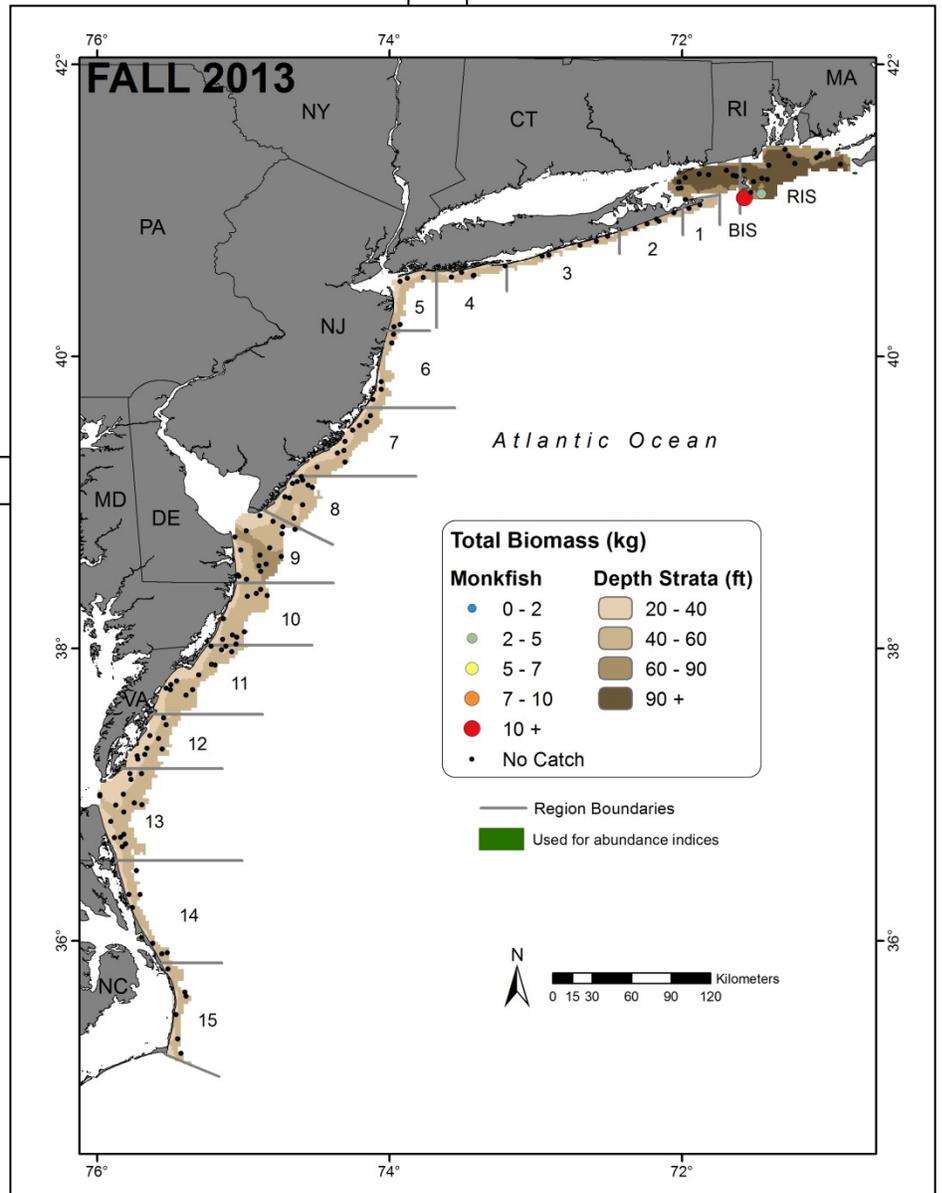
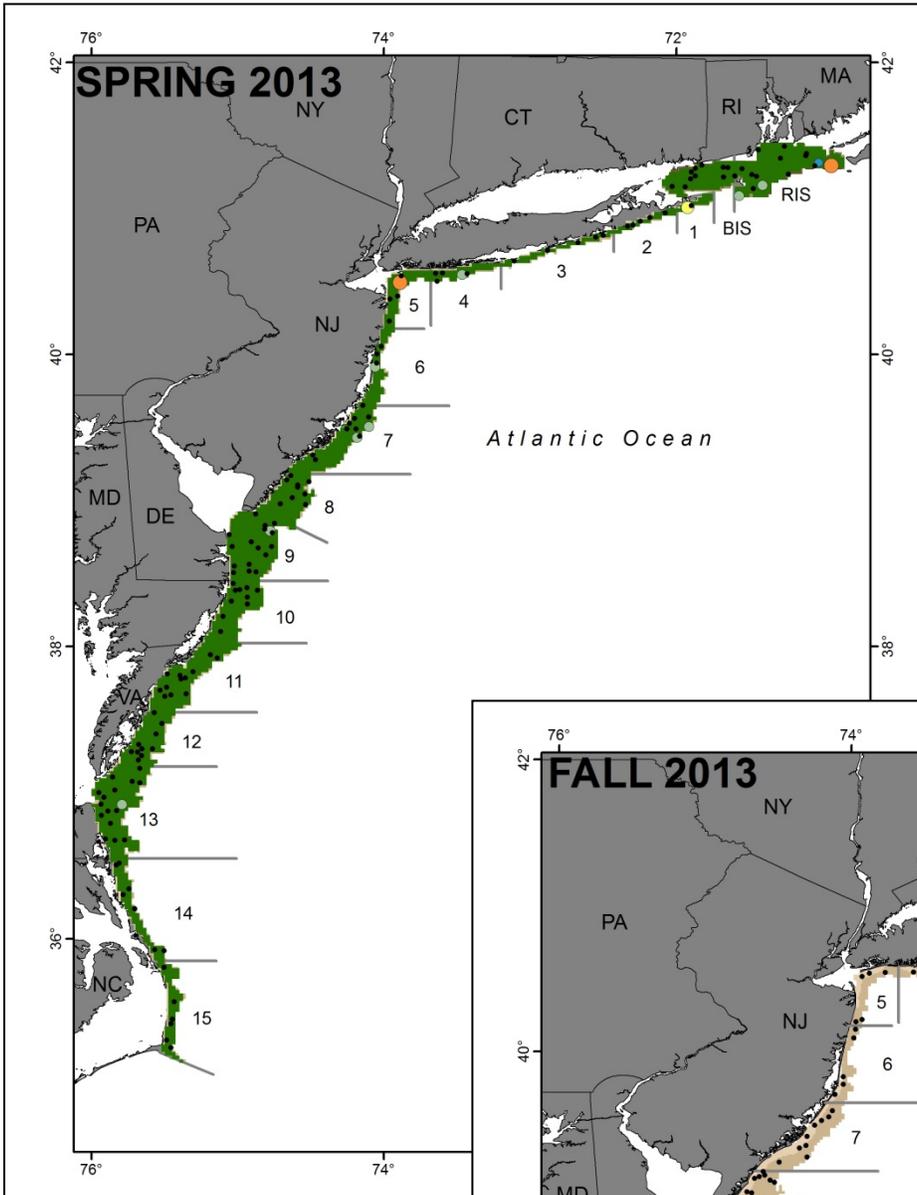
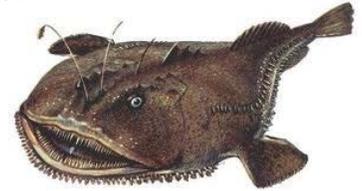
Figure 12. Alewife diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled).



American Goosefish

Sampling Priority: A

Figure 13. American Goosefish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	■
	BIS	90+		
NY	01	40-60	■	■
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40	■	■
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40	■	■
	10	40-60		
	10	60-90		
MD	10	20-40	■	■
	11	40-60		
VA	11	20-40	■	■
	12	40-60		
	12	20-40		
	13	40-60		
NC	14	20-40	■	■
	15	40-60		
	15	20-40		
		40-60		

■ = used for abundance indices
 ■ = not used for abundance indices

Total Biomass (kg)

Monkfish	Depth Strata (ft)
● 0 - 2	■ 20 - 40
● 2 - 5	■ 40 - 60
● 5 - 7	■ 60 - 90
● 7 - 10	■ 90 +
● 10 +	
● No Catch	

— Region Boundaries
 ■ Used for abundance indices

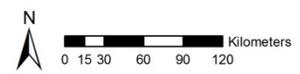


Table 9. American Goosefish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	31	130.8	31	31	0	23	23
	2009	18	71.0	18	18	0	10	10
	2010	11	37.4	11	11	0	7	7
	2011	14	45.4	14	14	0	9	8
	2012	48	91.1	48	44	0	30	29
	2013	16	45.6	16	16	0	11	11
Fall	2007	6	31.2	6	6	0	6	6
	2008	6	26.2	6	6	0	6	6
	2009	3	0.6	3	0	0	0	0
	2010	-	0.0	0	0	0	0	0
	2011	1	3.2	1	1	0	1	0
	2012	-	0.0	0	0	0	0	0
	2013	3	17.1	3	3	0	2	0

Table 10. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	0.10	0.16	0.22	0.22	0.37	0.54
	2009	160	0.05	0.09	0.14	0.10	0.20	0.31
	2010	150	0.02	0.06	0.09	0.04	0.12	0.20
	2011	150	0.03	0.06	0.10	0.05	0.12	0.20
	2012	150	0.11	0.19	0.27	0.17	0.28	0.39
	2013	150	0.03	0.07	0.12	0.05	0.13	0.22
	2014							
	2015							
	2016							

Figure 14. American Goosefish geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

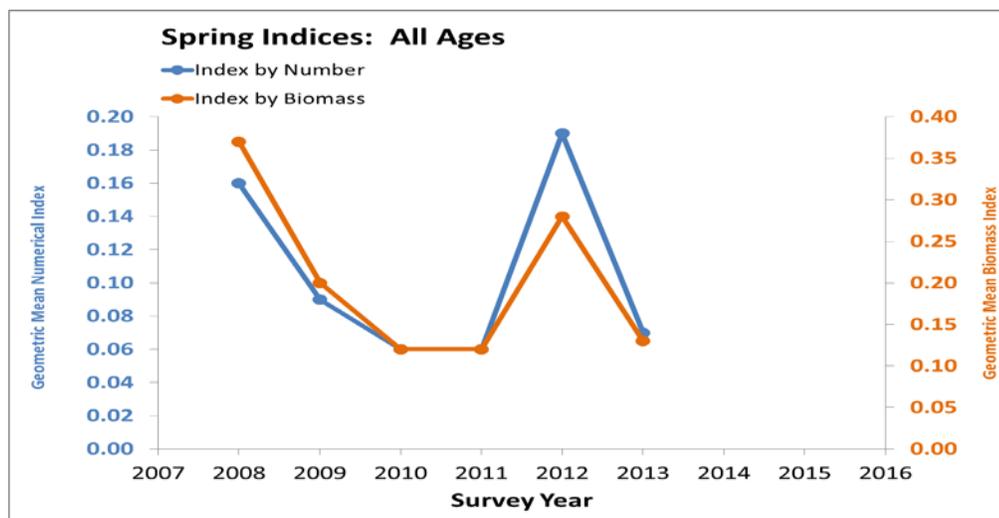


Figure 15. American Goosefish length-frequency distributions, by cruise.

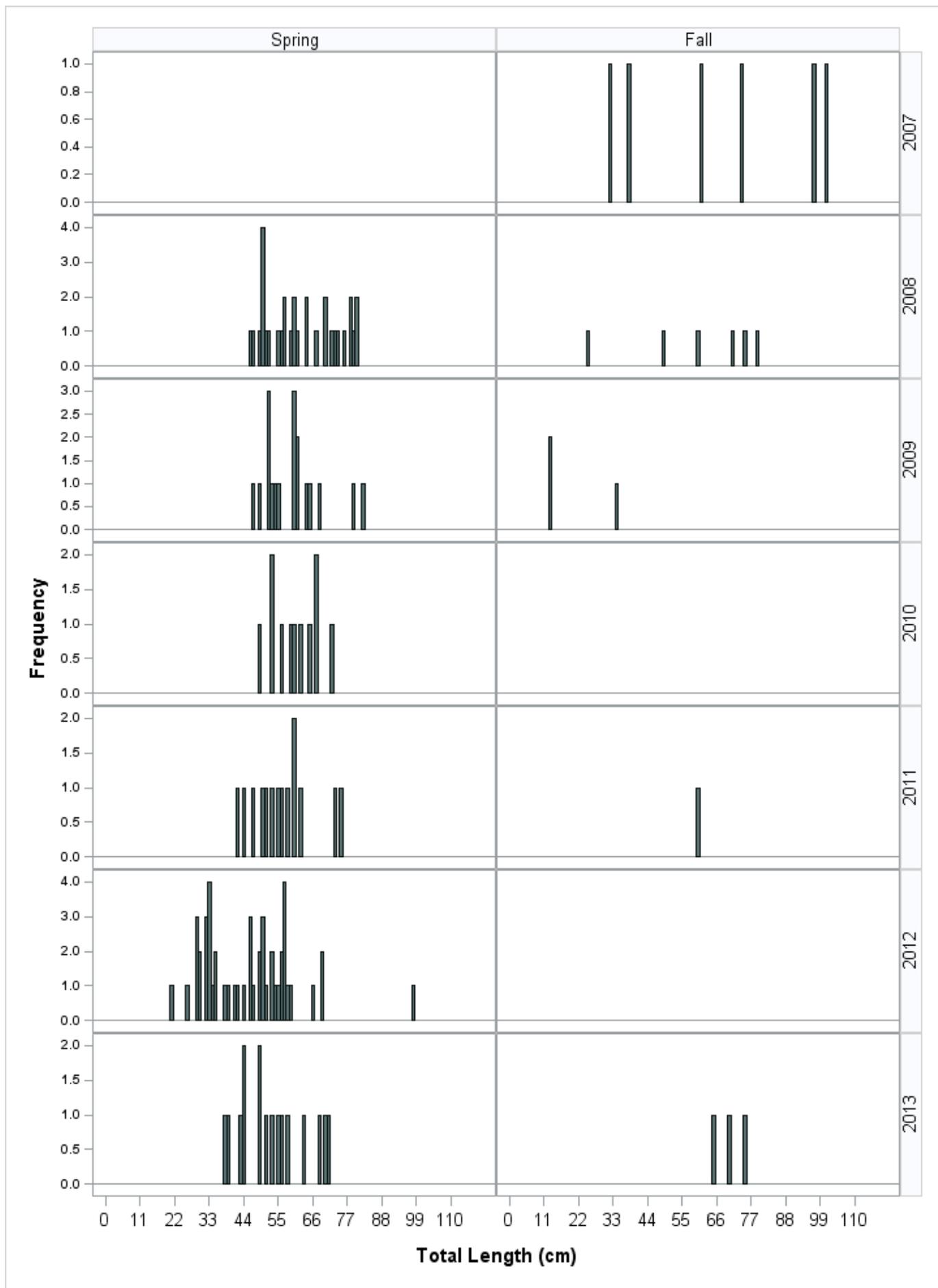


Figure 16. American Goosefish length-frequency distributions, by cruise and sex.

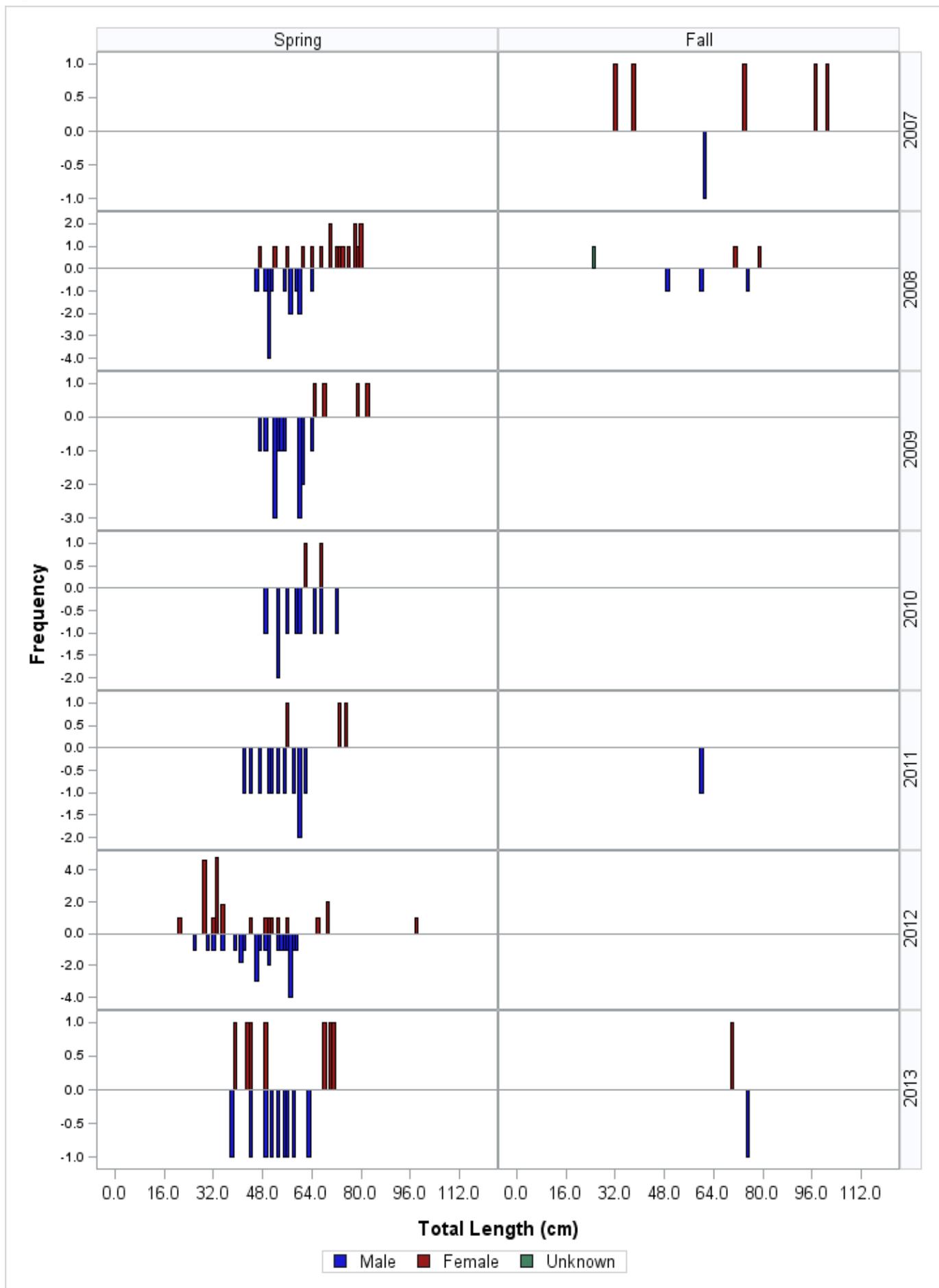
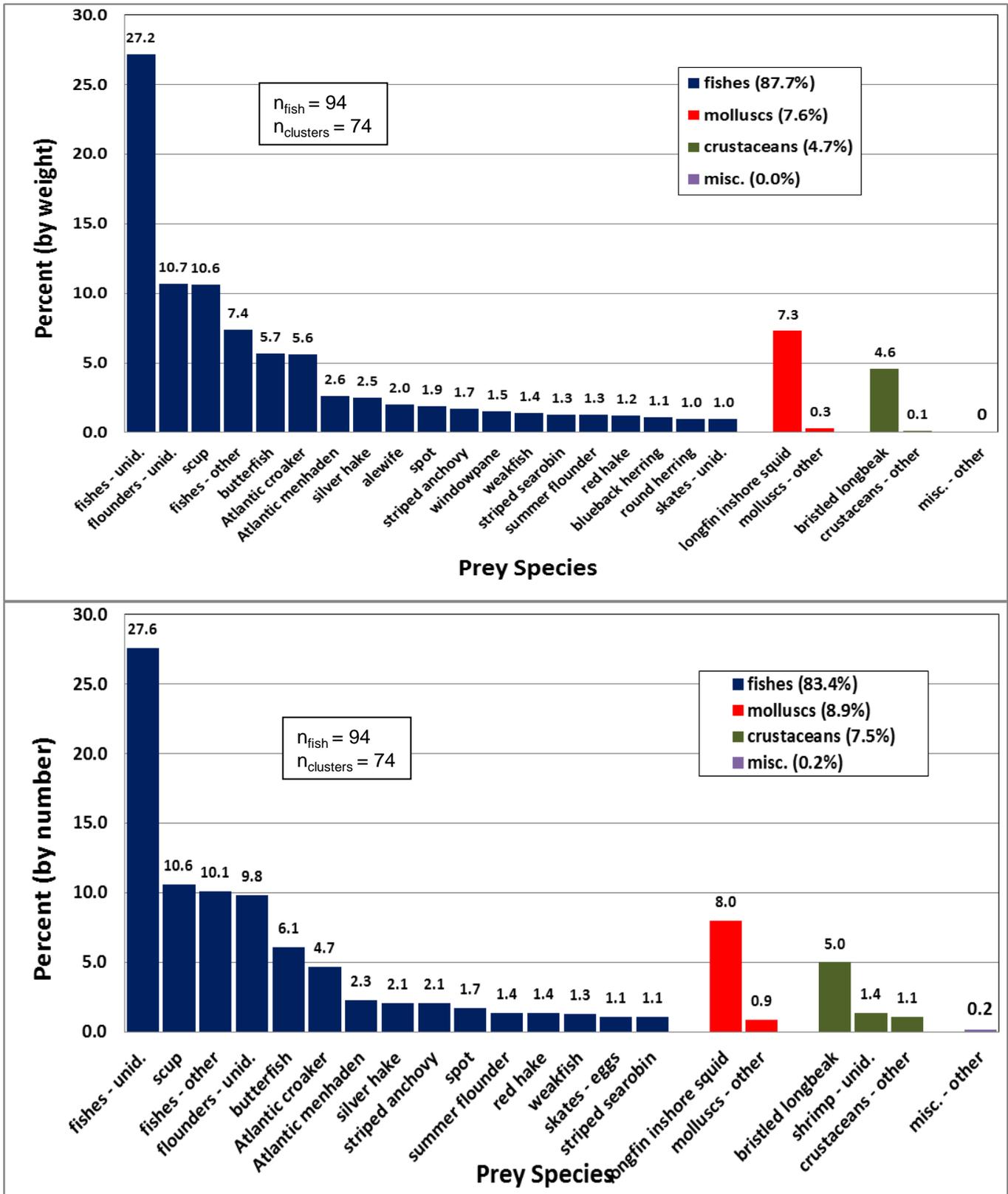


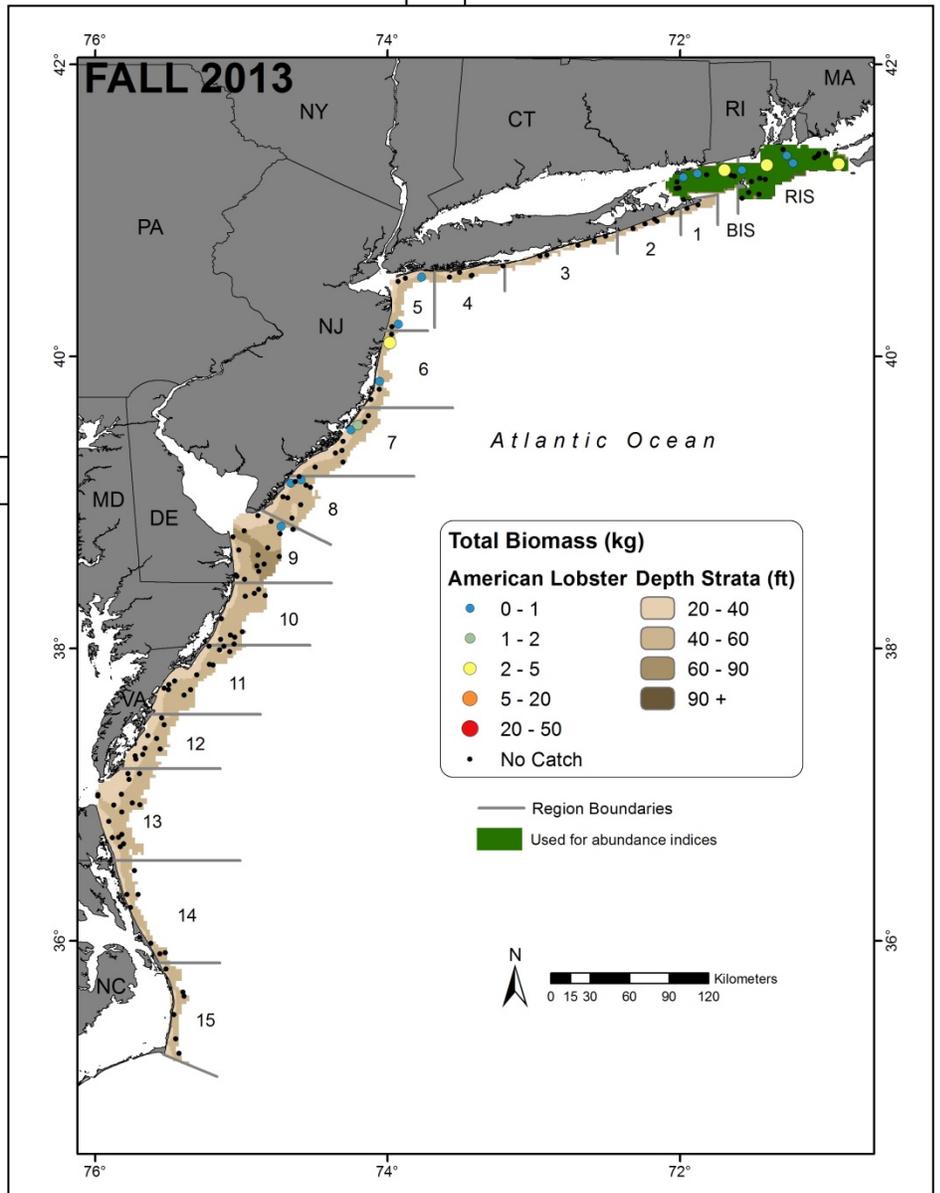
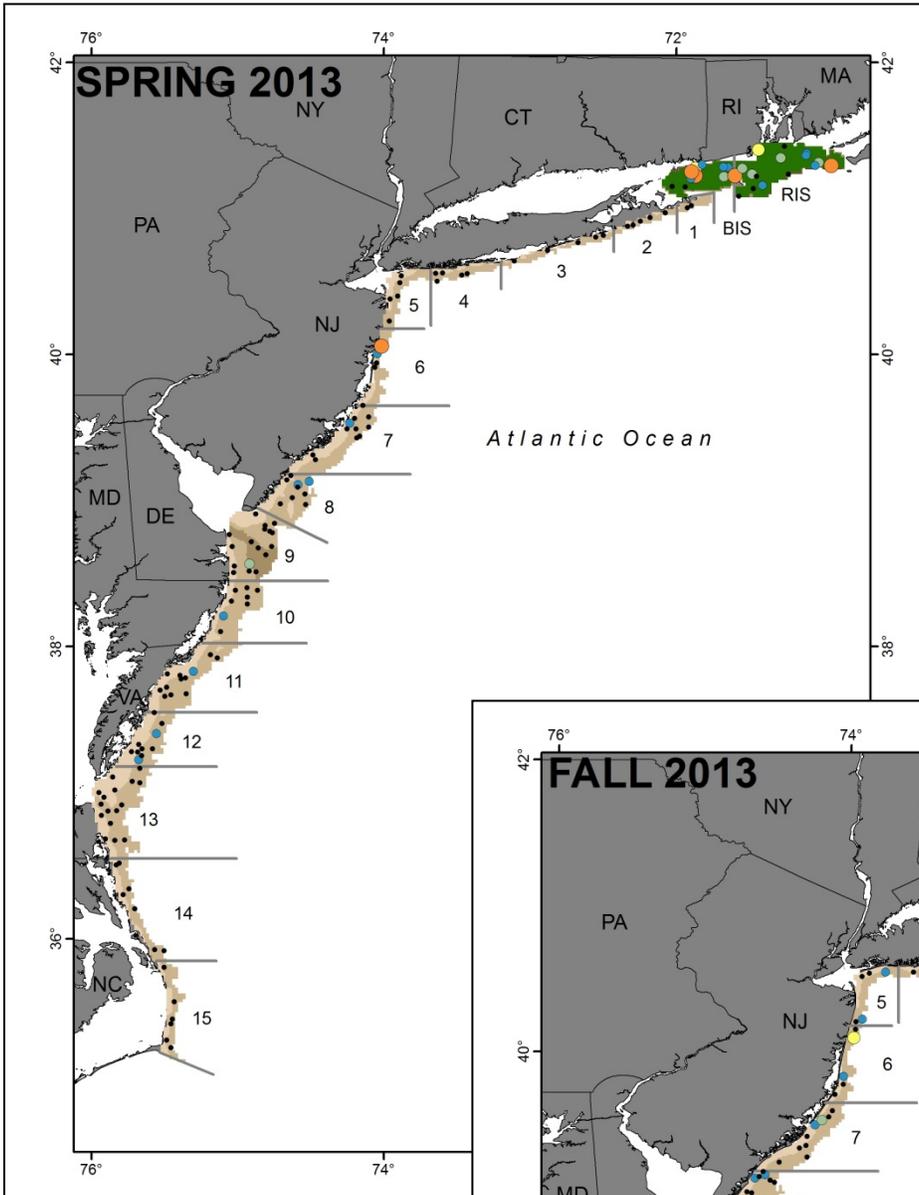
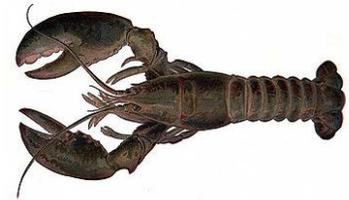
Figure 17. American Goosefish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled).



American Lobster

Sampling Priority: E

Figure 18. American Lobster biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	■
	BIS	90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
	04	40-60		
NJ	05	20-40		
		40-60		
	06	20-40		
	07	40-60		
DE	08	20-40		
		40-60		
	09	60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
	12	20-40		
NC	13	40-60		
	14	20-40		
NC	15	40-60		
		20-40		

■ = used for abundance indices
 □ = not used for abundance indices

Table 11. American Lobster sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	519	90.5	286	N/A	N/A	N/A	N/A
	2009	290	89.9	248	N/A	N/A	N/A	N/A
	2010	86	24.0	86	N/A	N/A	N/A	N/A
	2011	216	67.1	216	N/A	N/A	N/A	N/A
	2012	102	33.2	102	N/A	N/A	N/A	N/A
	2013	230	67.9	230	27	N/A	N/A	N/A
Fall	2007	262	59.1	262	N/A	N/A	N/A	N/A
	2008	352	80.6	178	N/A	N/A	N/A	N/A
	2009	89	29.1	89	N/A	N/A	N/A	N/A
	2010	63	19.4	63	N/A	N/A	N/A	N/A
	2011	106	30.2	106	N/A	N/A	N/A	N/A
	2012	127	29.6	127	N/A	N/A	N/A	N/A
	2013	59	19.7	59	N/A	N/A	N/A	N/A

Table 12. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	26	0.98	2.40	4.86	0.34	0.88	1.66
	2008	27	2.16	4.39	8.20	0.63	1.29	2.21	2008	26	1.73	3.18	5.39	0.50	1.04	1.77	
	2009	26	2.03	3.74	6.41	0.85	1.58	2.60	2009	26	0.79	1.59	2.74	0.26	0.57	0.96	
	2010	26	0.54	1.28	2.38	0.23	0.53	0.92	2010	26	0.47	1.01	1.74	0.14	0.36	0.63	
	2011	26	0.97	2.31	4.57	0.31	0.90	1.76	2011	26	0.96	1.93	3.37	0.33	0.71	1.19	
	2012	26	1.22	2.22	3.67	0.52	0.92	1.43	2012	26	0.39	1.15	2.32	0.14	0.50	0.96	
	2013	26	1.23	2.65	4.97	0.49	1.08	1.91	2013	26	0.15	0.59	1.20	0.07	0.30	0.59	
	2014								2014								
	2015								2015								
	2016								2016								
Female	2007								Female	2007	26	0.56	1.48	2.95	0.15	0.52	0.99
	2008	27	1.03	2.30	4.37	0.31	0.74	1.30	2008	26	0.61	1.45	2.73	0.19	0.58	1.10	
	2009	26	1.10	2.25	4.04	0.51	1.07	1.82	2009	26	0.18	0.58	1.10	0.06	0.23	0.44	
	2010	26	0.24	0.70	1.34	0.10	0.32	0.58	2010	26	0.12	0.44	0.84	0.03	0.19	0.38	
	2011	26	0.43	1.23	2.49	0.14	0.55	1.12	2011	26	0.47	1.01	1.76	0.14	0.39	0.69	
	2012	26	0.62	1.31	2.30	0.28	0.60	1.00	2012	26	0.20	0.68	1.35	0.08	0.31	0.58	
	2013	26	0.57	1.37	2.59	0.27	0.69	1.24	2013	26	0.00	0.32	0.74	0.00	0.16	0.34	
	2014								2014								
	2015								2015								
	2016								2016								
Male	2007								Male	2007	26	0.50	1.32	2.59	0.17	0.50	0.92
	2008	27	1.21	2.41	4.27	0.31	0.71	1.24	2008	26	0.71	1.60	2.97	0.15	0.53	1.04	
	2009	26	0.90	1.69	2.82	0.32	0.62	0.99	2009	26	0.42	0.95	1.67	0.13	0.34	0.60	
	2010	26	0.29	0.73	1.32	0.10	0.28	0.48	2010	26	0.31	0.64	1.06	0.08	0.19	0.31	
	2011	26	0.59	1.38	2.58	0.16	0.46	0.85	2011	26	0.51	1.11	1.95	0.17	0.36	0.57	
	2012	26	0.52	0.93	1.46	0.19	0.35	0.54	2012	26	0.21	0.77	1.58	0.04	0.31	0.64	
	2013	26	0.64	1.48	2.75	0.20	0.52	0.91	2013	26	0.12	0.40	0.76	0.05	0.20	0.36	
	2014								2014								
	2015								2015								
	2016								2016								

Figure 19. American Lobster geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured, and by sex.

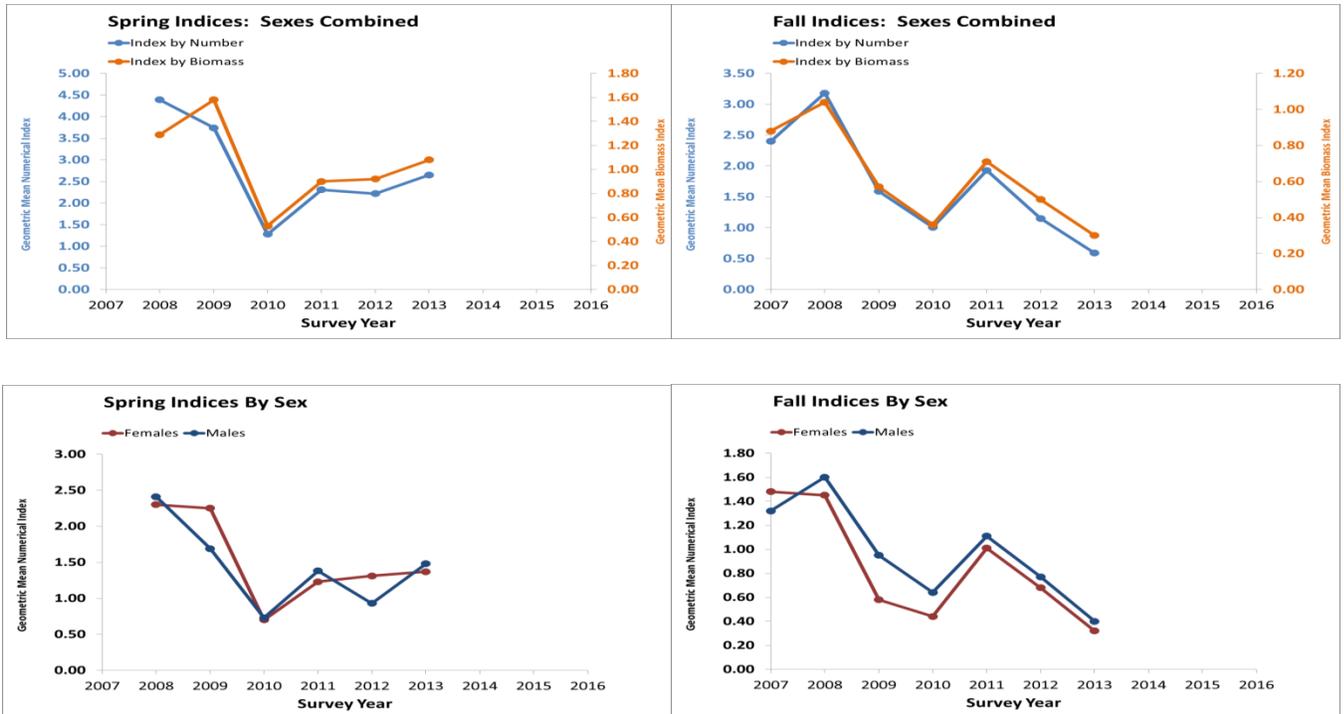


Figure 20. American Lobster length-frequency distributions, by cruise.

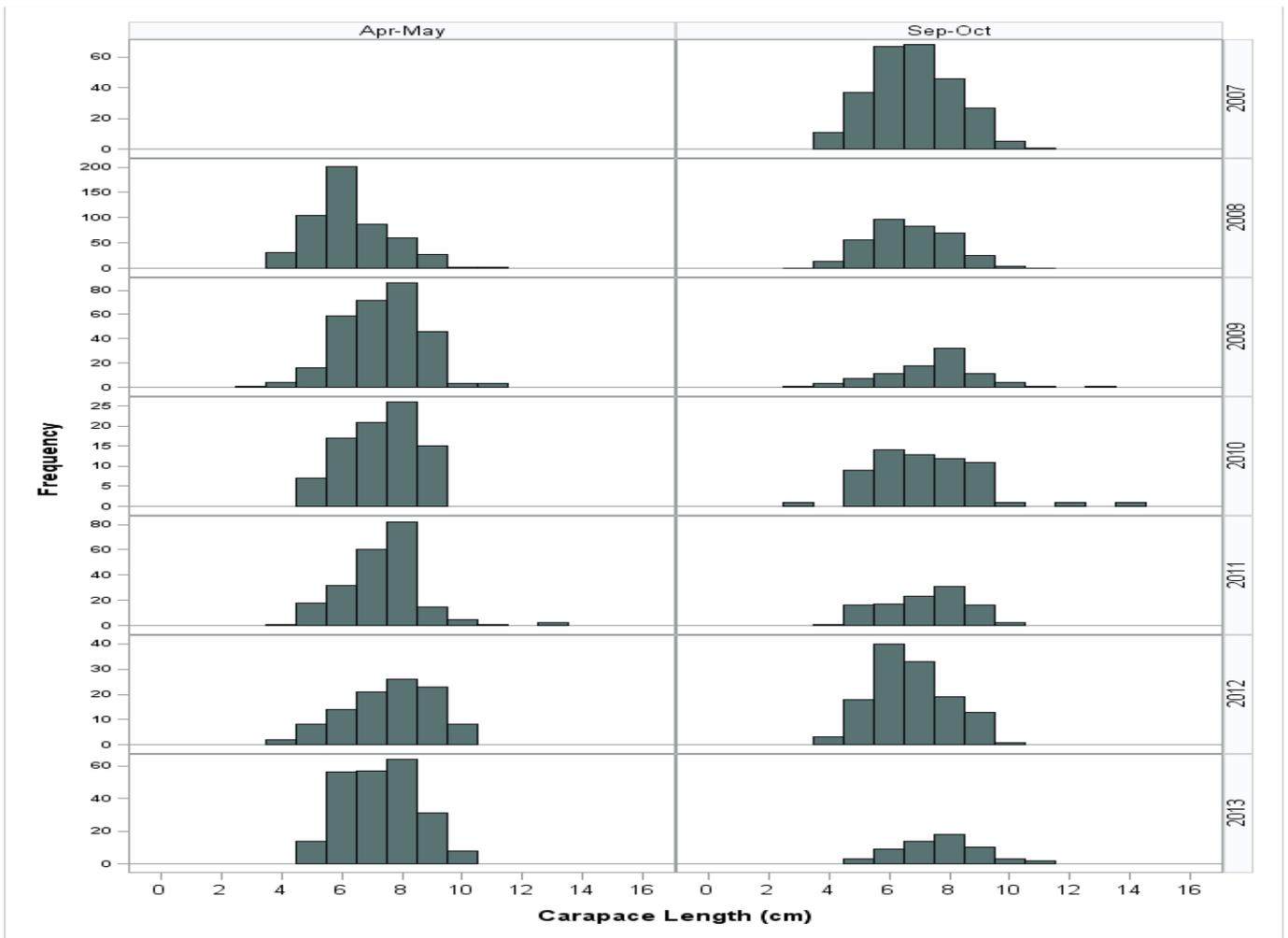


Figure 21. American Lobster length-frequency distributions, by cruise and sex.

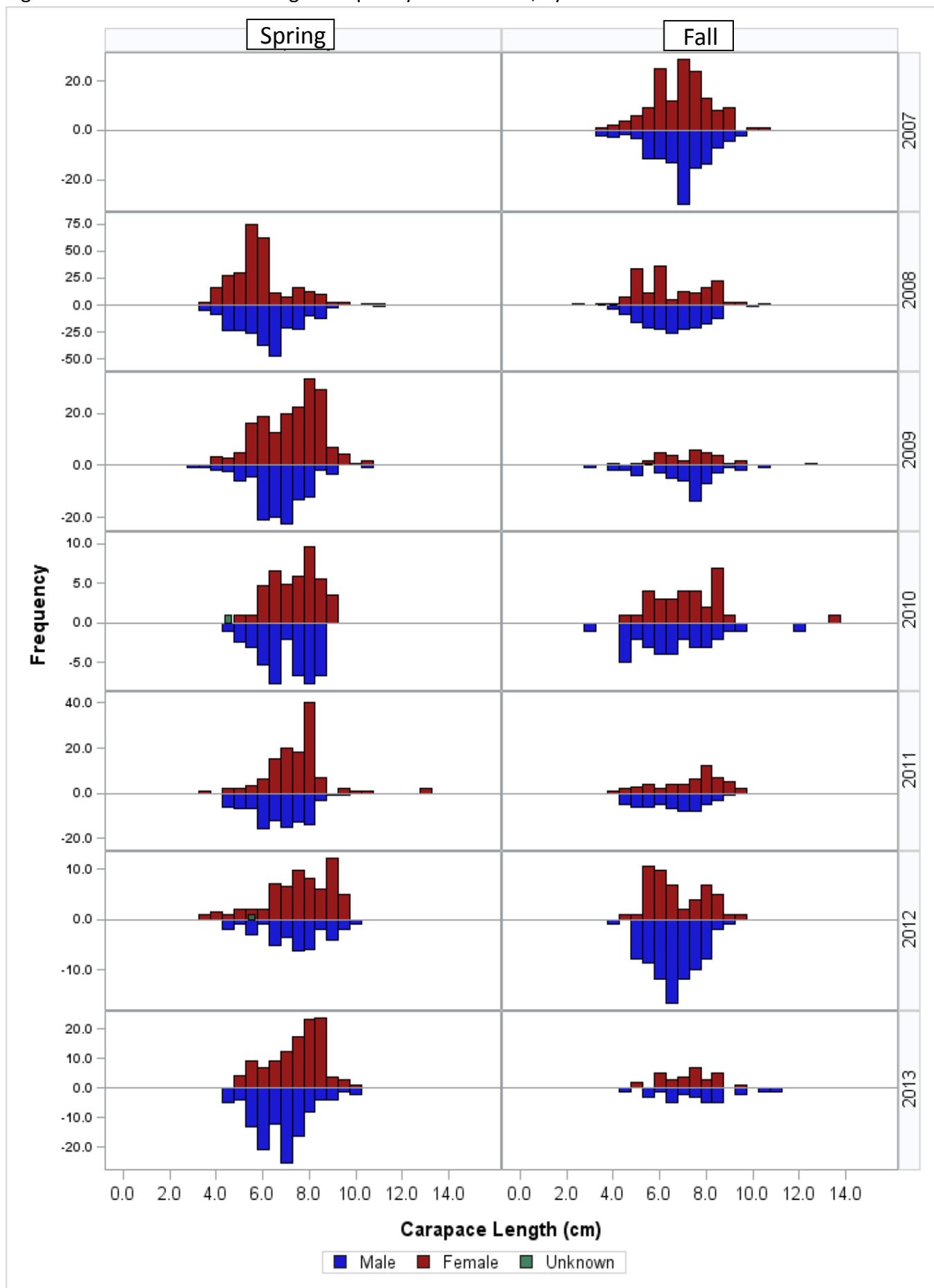


Figure 22. American Lobster sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

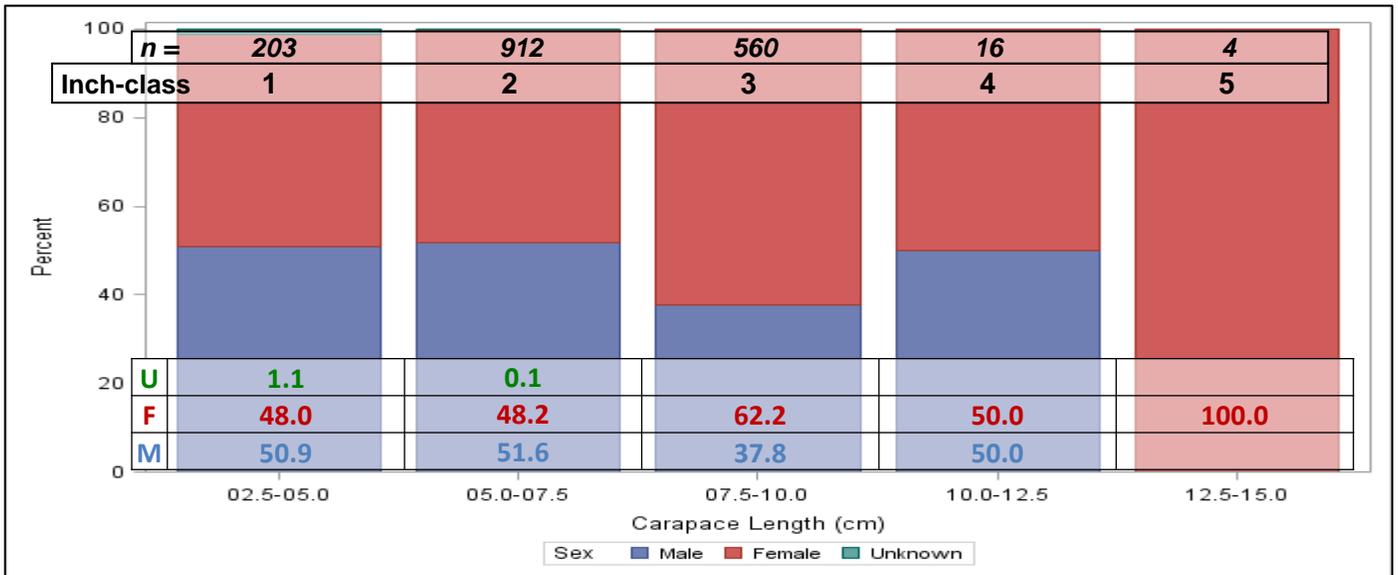


Figure 23. American Lobster disease status (percent positive) by cruise, 2010-2013.

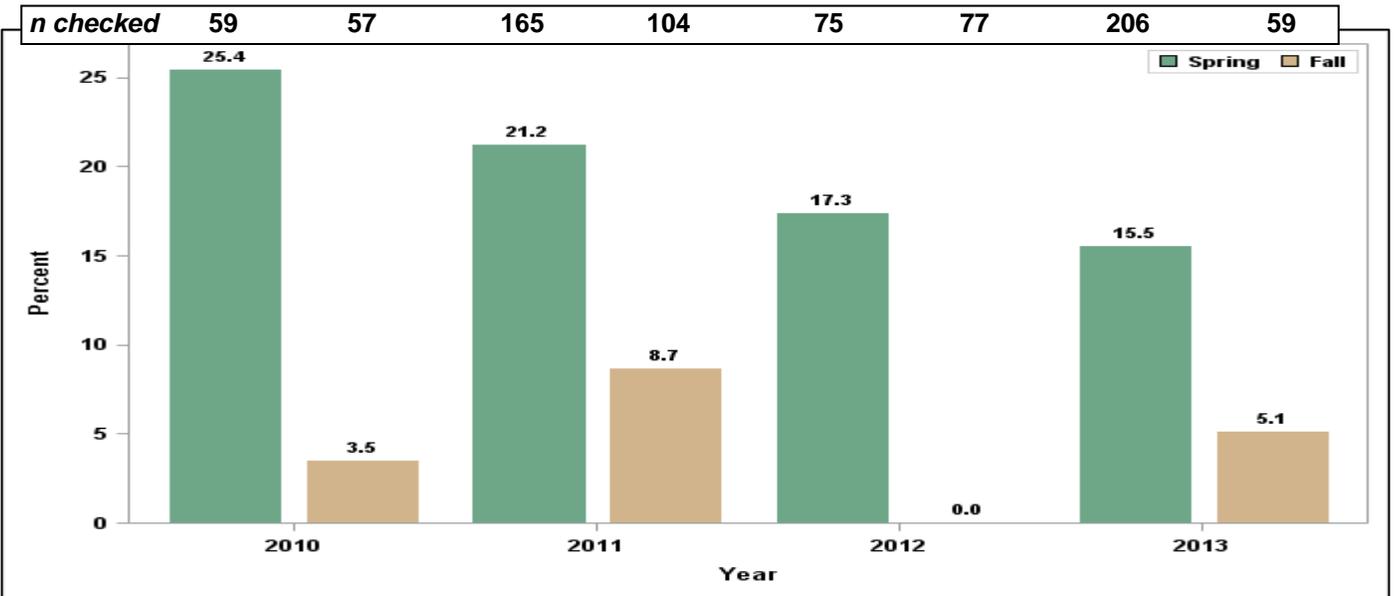
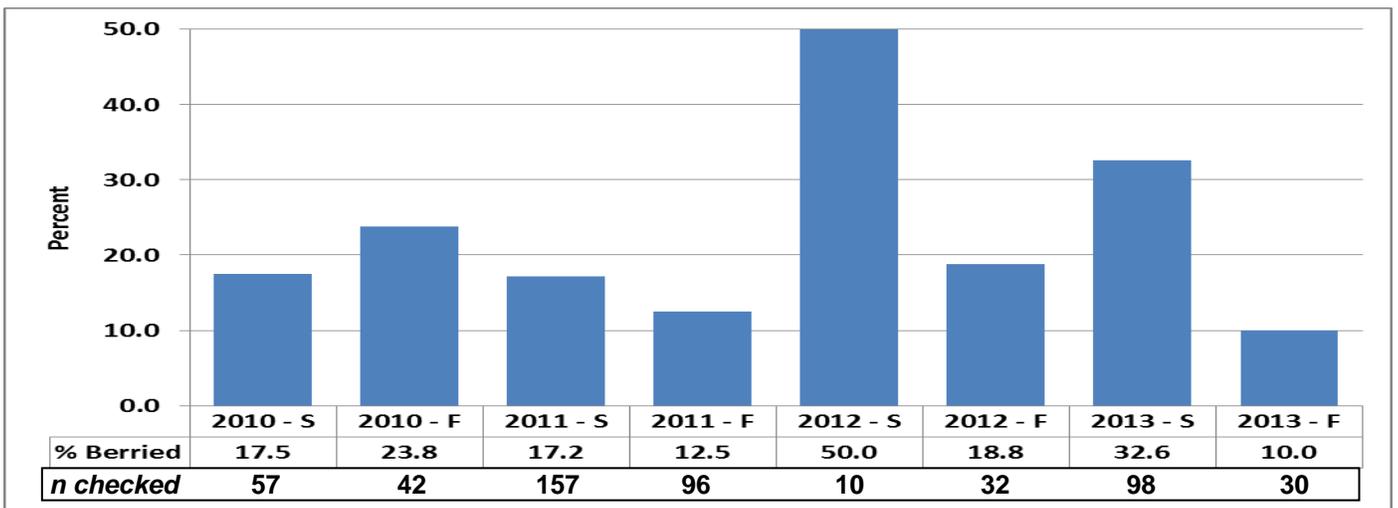


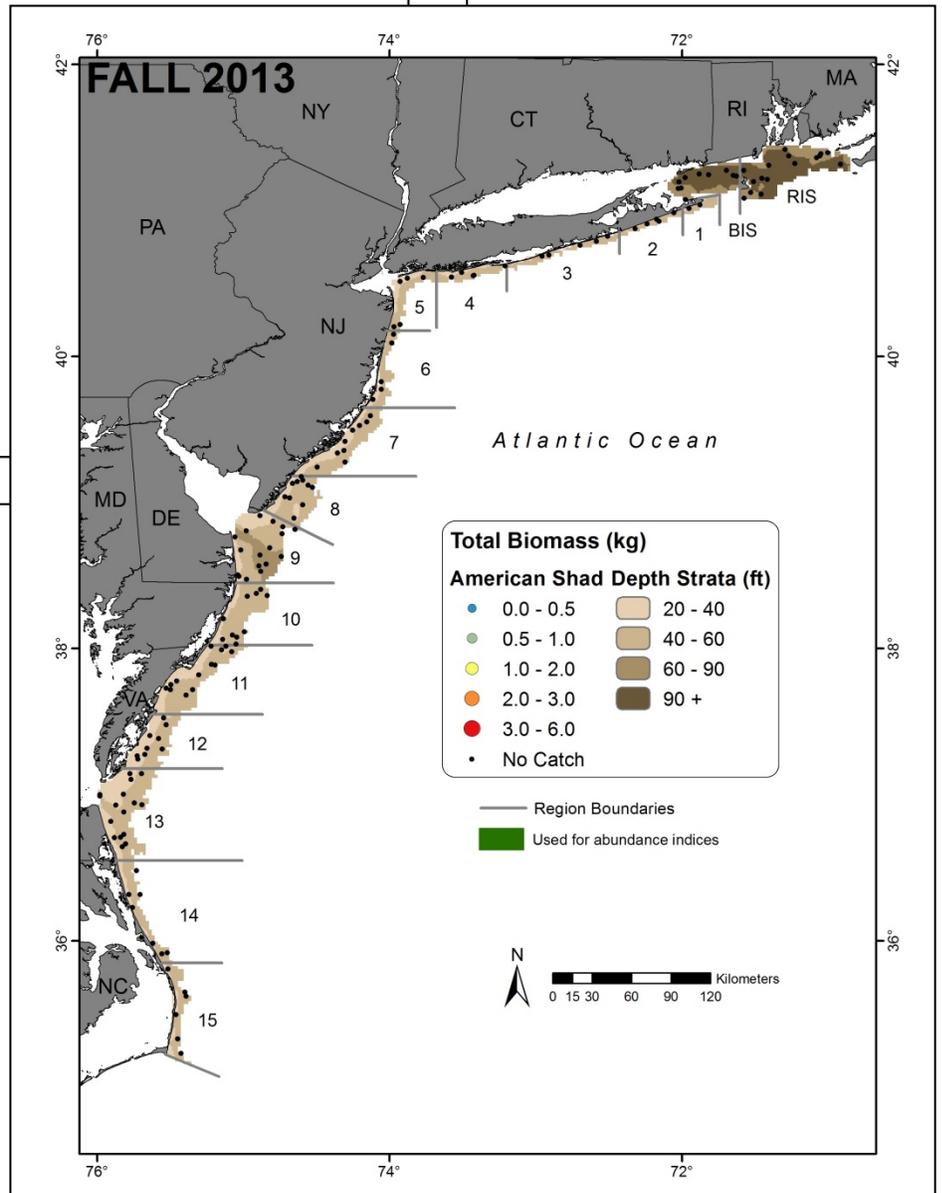
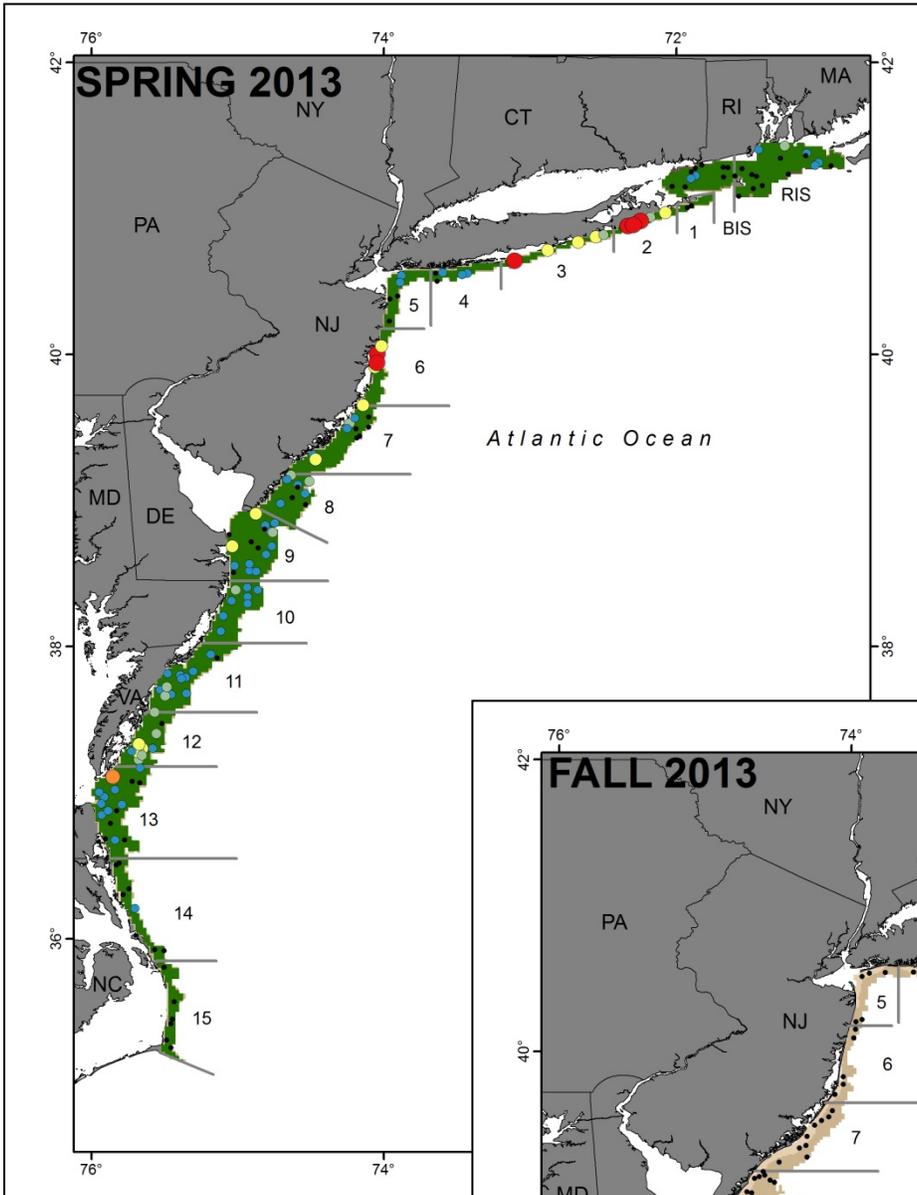
Figure 24. American Lobster percent of females with egg masses by cruise, 2010-2013.



American Shad

Sampling Priority: A

Figure 25. American shad biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	
	BIS	90+		
NY	01	40-60	■	
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40	■	
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40	■	
	09	40-60		
	09	60-90		
MD	10	20-40	■	
	10	40-60		
VA	11	20-40	■	
	11	40-60		
	12	20-40		
	12	40-60		
NC	14	20-40	■	
	14	40-60		
	15	20-40		
15	40-60			

■ = used for abundance indices
 □ = not used for abundance indices

Table 13. American Shad sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,205	40.8	1,205	327	0	321	0
	2009	1,141	33.2	859	260	0	260	9
	2010	1,236	43.8	942	274	0	273	22
	2011	1,712	73.6	1,418	251	0	249	248
	2012	1,191	40.4	1,191	299	0	294	284
	2013	2,755	73.4	2,210	371	0	366	344
Fall	2007	9	0.8	9	9	0	9	0
	2008	9	0.5	9	5	0	5	0
	2009	28	3.1	28	10	0	10	9
	2010	32	1.1	6	3	0	3	3
	2011	13	1.3	13	13	0	13	11
	2012	47	4.6	47	23	0	20	17
	2013	-	0.0	0	0	0	0	0

Table 14. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	1.81	2.36	3.02	0.16	0.20	0.25
	2009	160	1.09	1.47	1.93	0.09	0.14	0.19
	2010	150	1.26	1.70	2.21	0.11	0.17	0.23
	2011	150	1.07	1.52	2.07	0.14	0.21	0.29
	2012	150	1.45	1.83	2.26	0.12	0.17	0.21
	2013	150	2.41	3.14	4.02	0.19	0.24	0.30
	2014							
	2015							
	2016							

Figure 26. American Shad geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured.

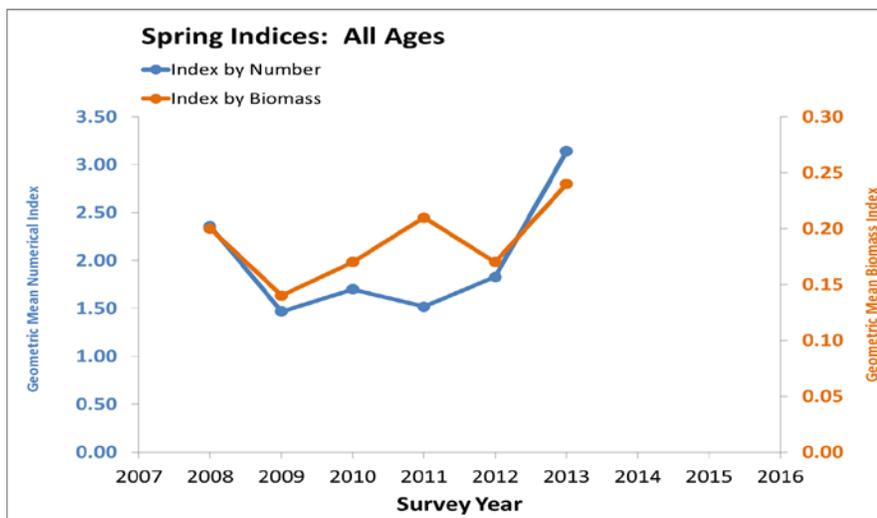


Figure 27. American Shad length-frequency distributions, by cruise.

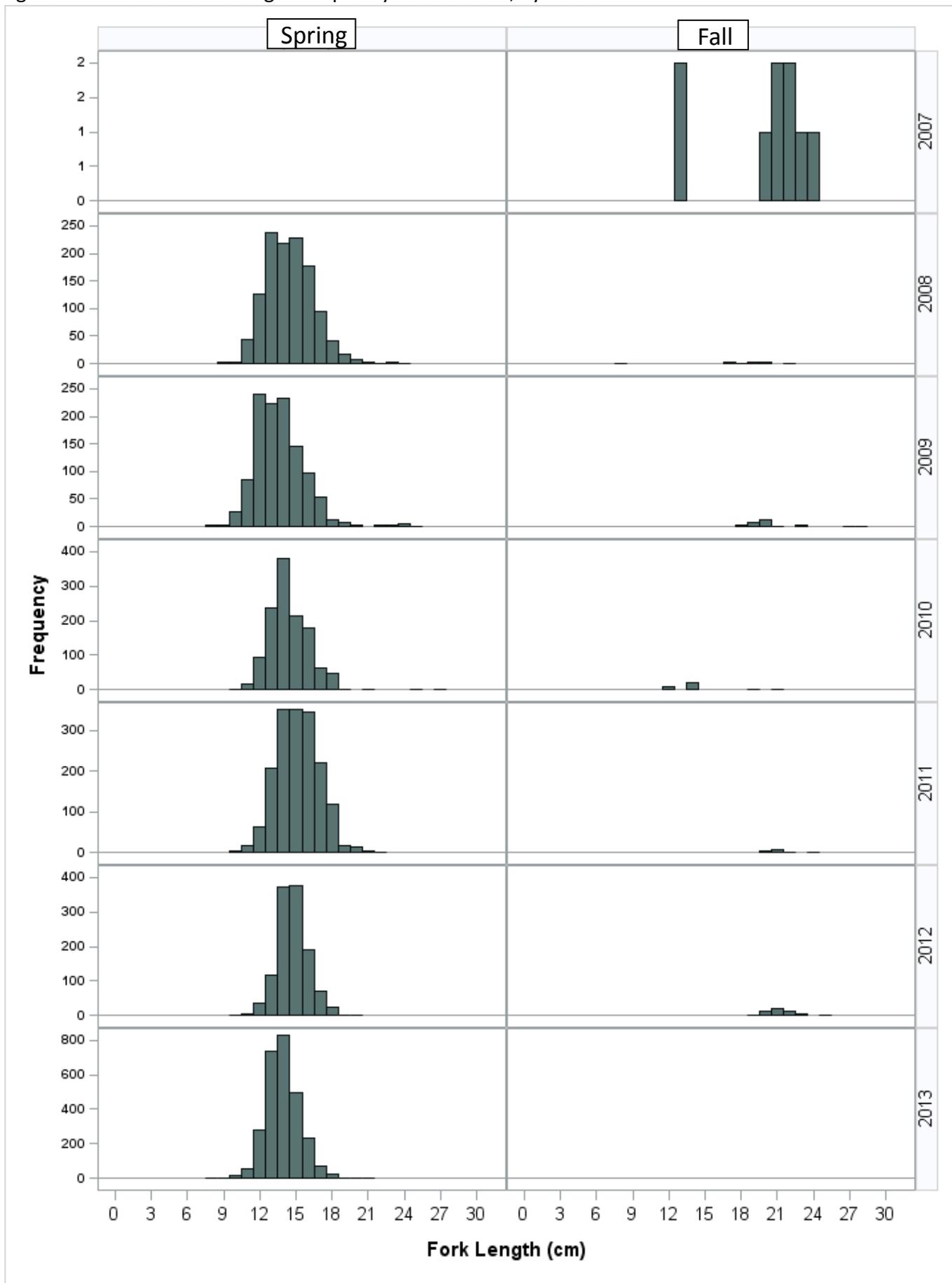


Figure 28. American Shad length-frequency distributions, by cruise and sex.

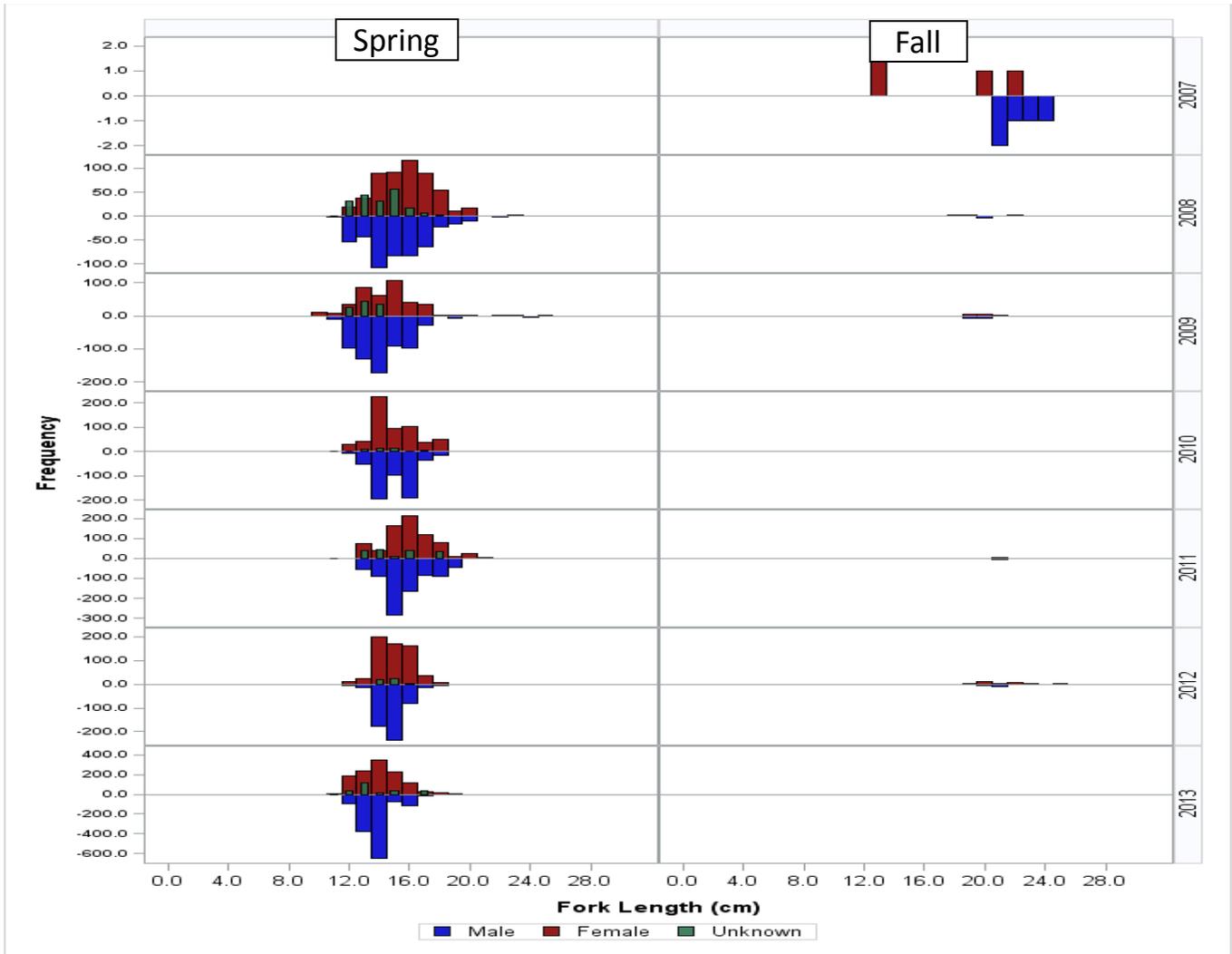


Figure 29. American Shad sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

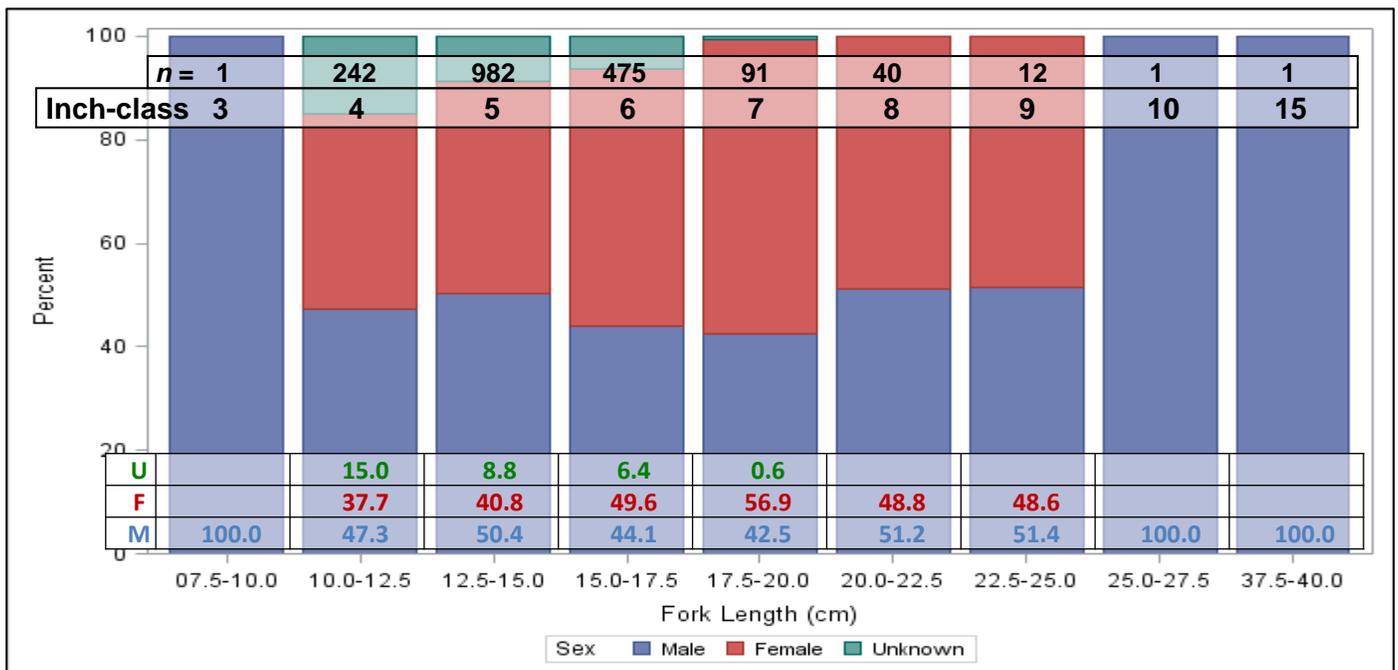
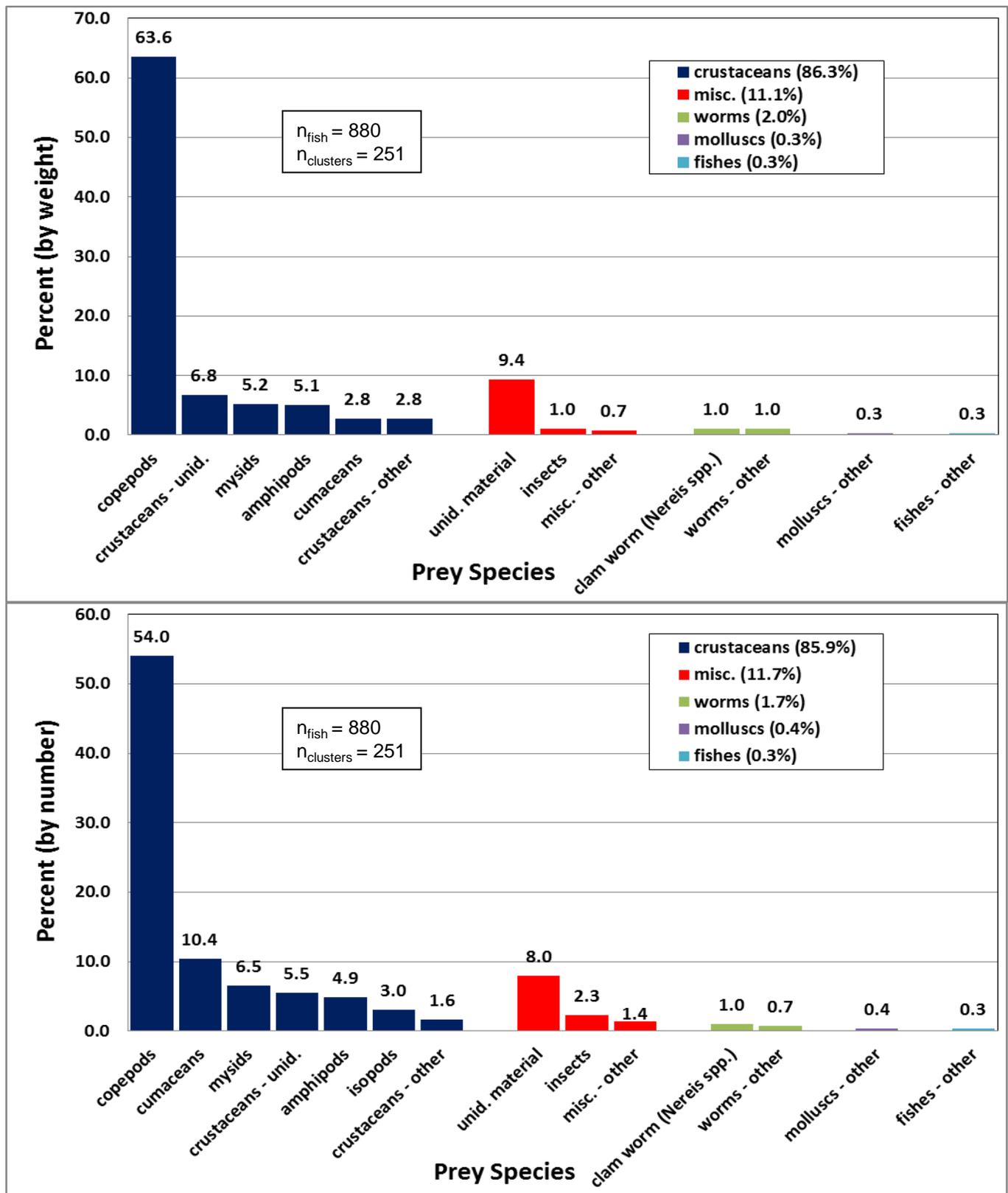


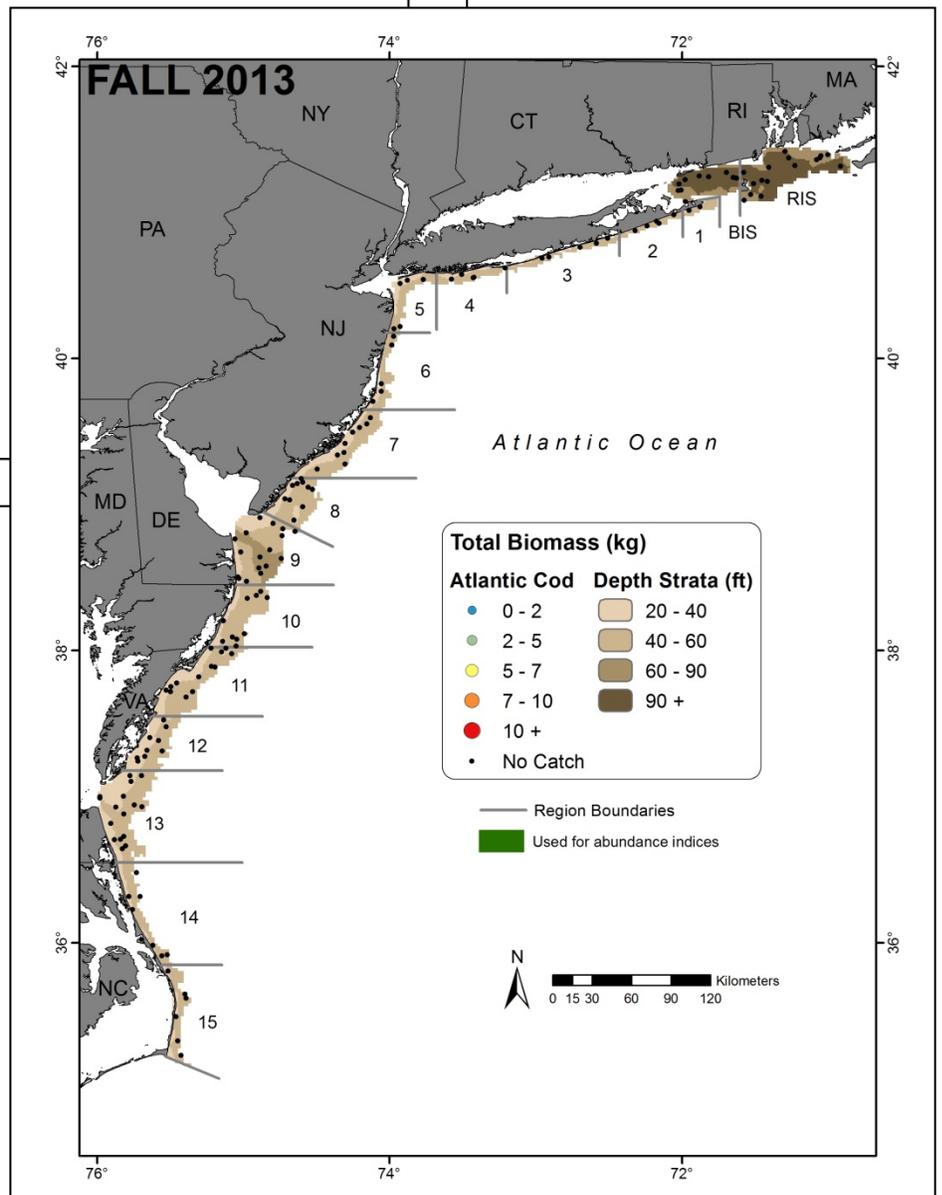
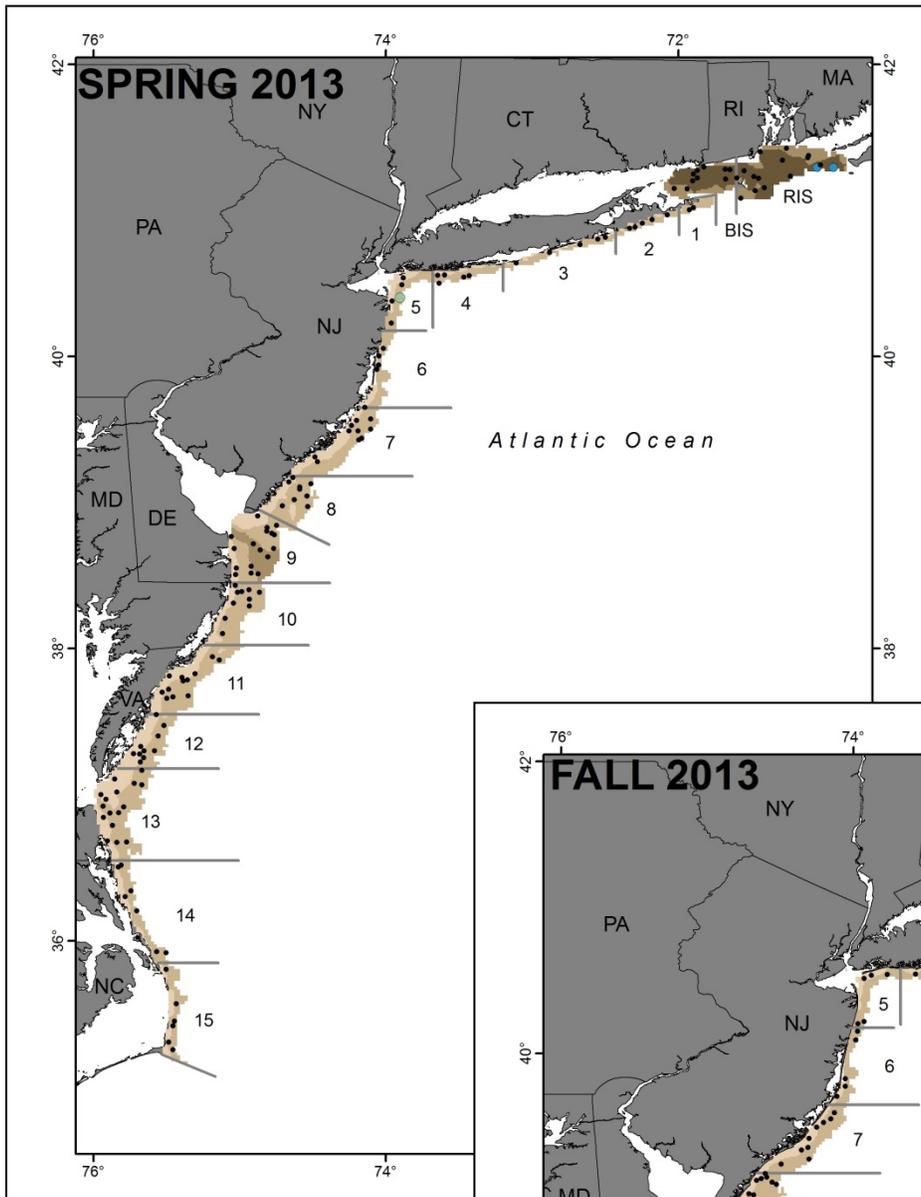
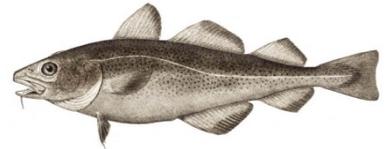
Figure 30. American Shad diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Atlantic Cod

Sampling Priority: A

Figure 31. Atlantic Cod biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
	09	60-90		
MD	10	20-40		
VA	11	20-40		
	11	40-60		
	11	20-40		
	11	40-60		
NC	14	20-40		
	14	40-60		
	14	20-40		

= used for abundance indices
 = not used for abundance indices

Total Biomass (kg)

Atlantic Cod

- 0 - 2
- 2 - 5
- 5 - 7
- 7 - 10
- 10 +
- No Catch

Depth Strata (ft)

- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

Region Boundaries
 Used for abundance indices

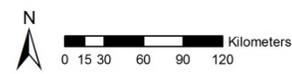


Table 15. Atlantic Cod sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	-	0.0	0	0	0	0	0
	2009	2	2.3	2	2	0	1	1
	2010	-	0.0	0	0	0	0	0
	2011	15	4.8	15	15	0	13	12
	2012	6	13.6	6	6	0	6	6
	2013	3	5.8	3	3	0	3	3
Fall	2007	-	0.0	0	0	0	0	0
	2008	-	0.0	0	0	0	0	0
	2009	-	0.0	0	0	0	0	0
	2010	-	0.0	0	0	0	0	0
	2011	-	0.0	0	0	0	0	0
	2012	-	0.0	0	0	0	0	0

Figure 32. Atlantic Cod length-frequency distributions, by cruise.

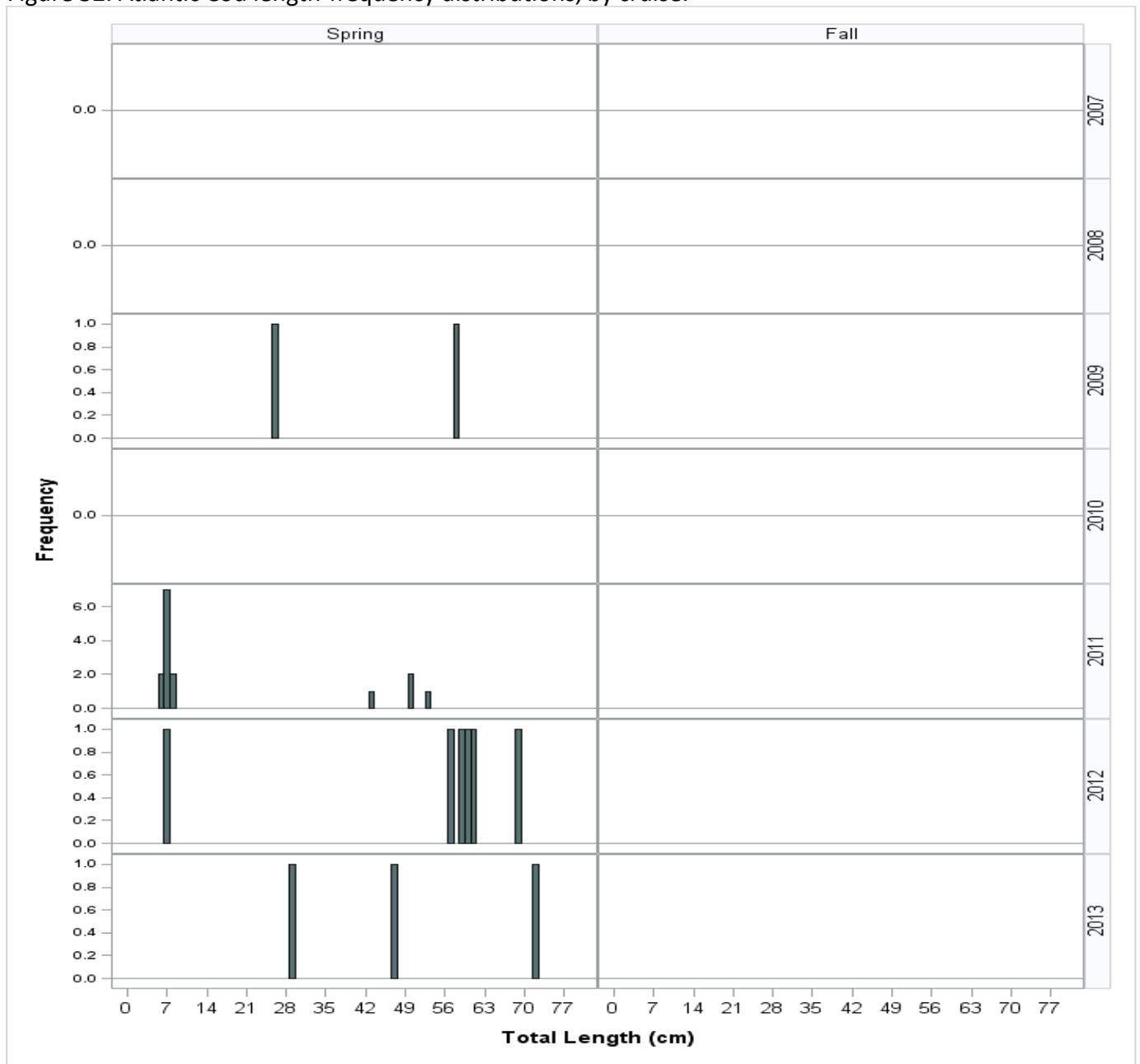
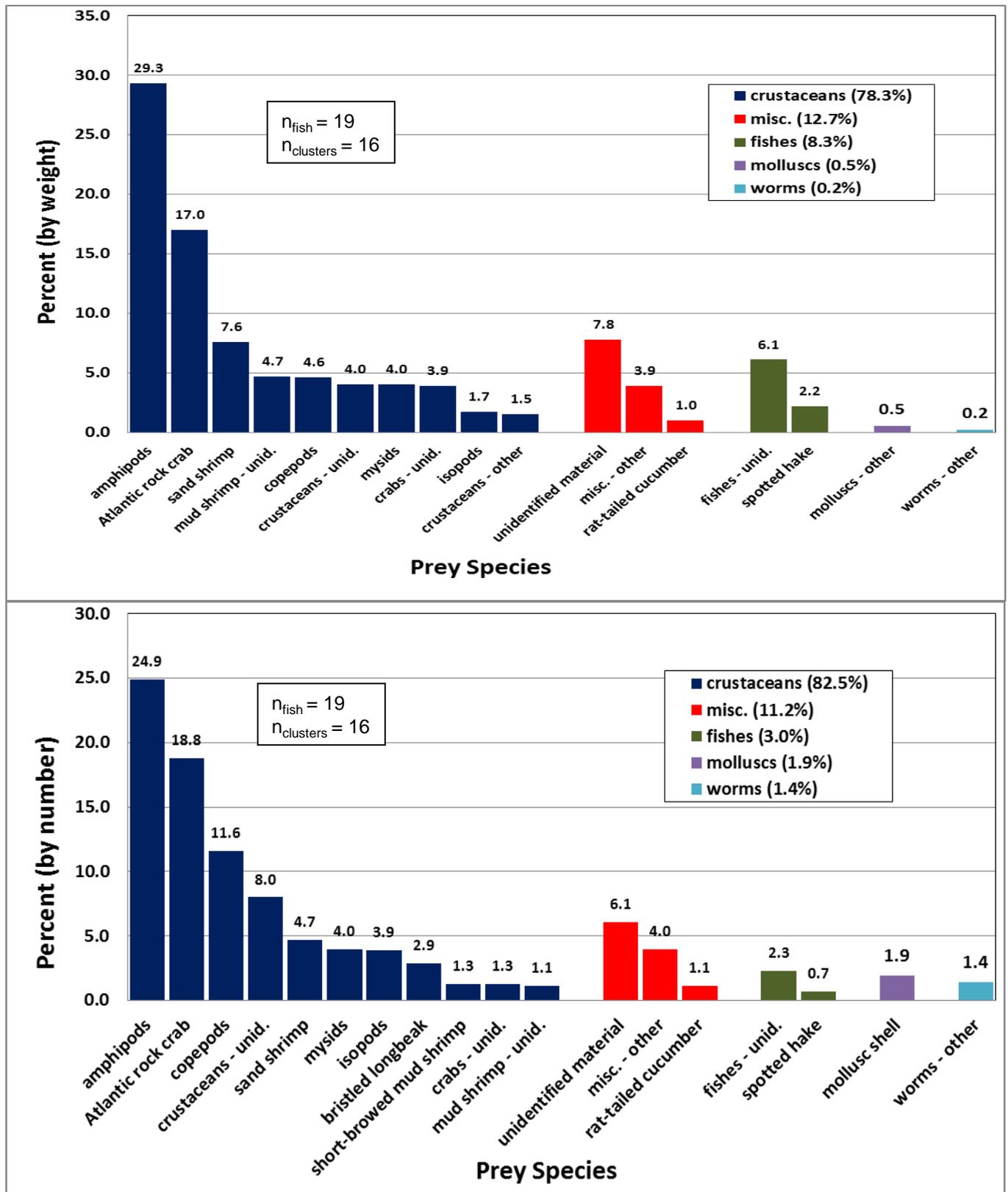


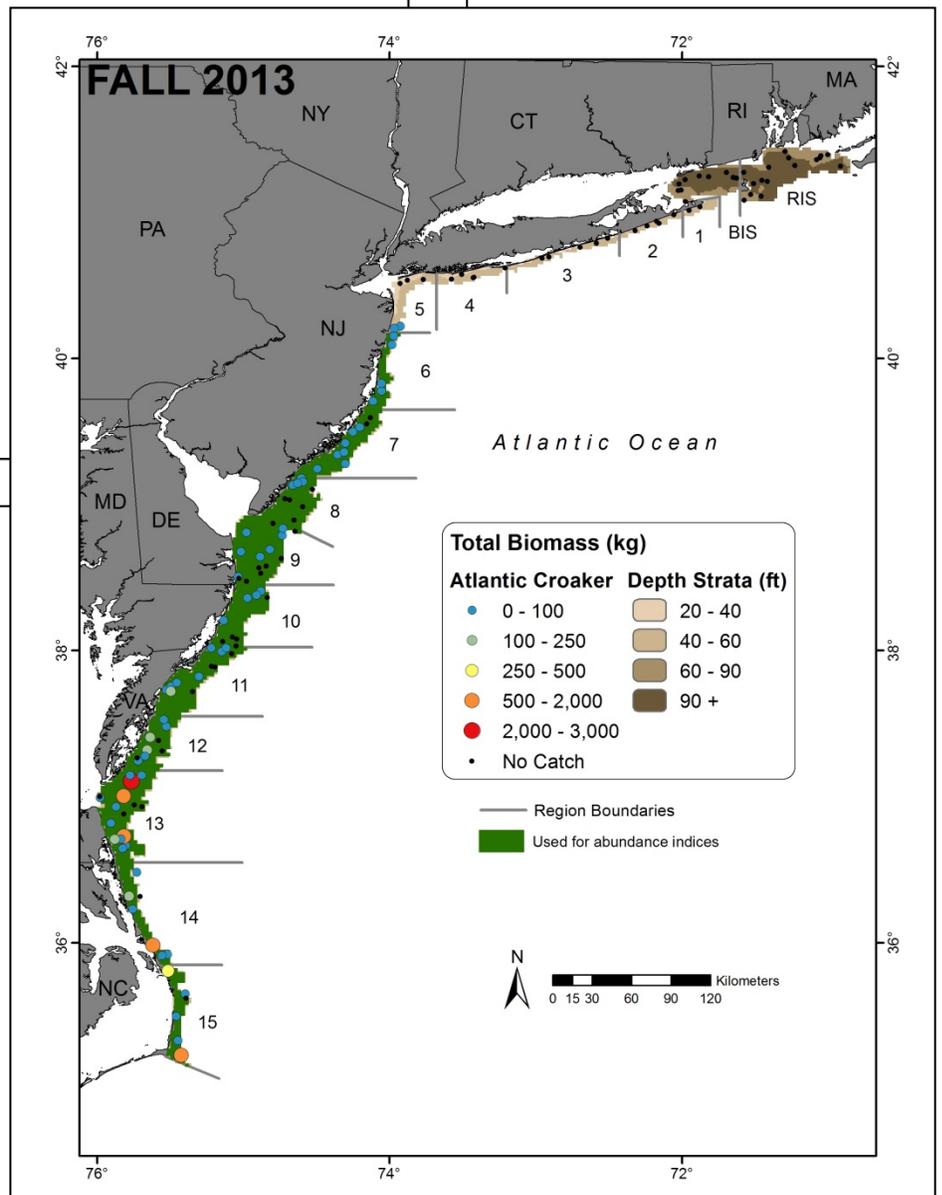
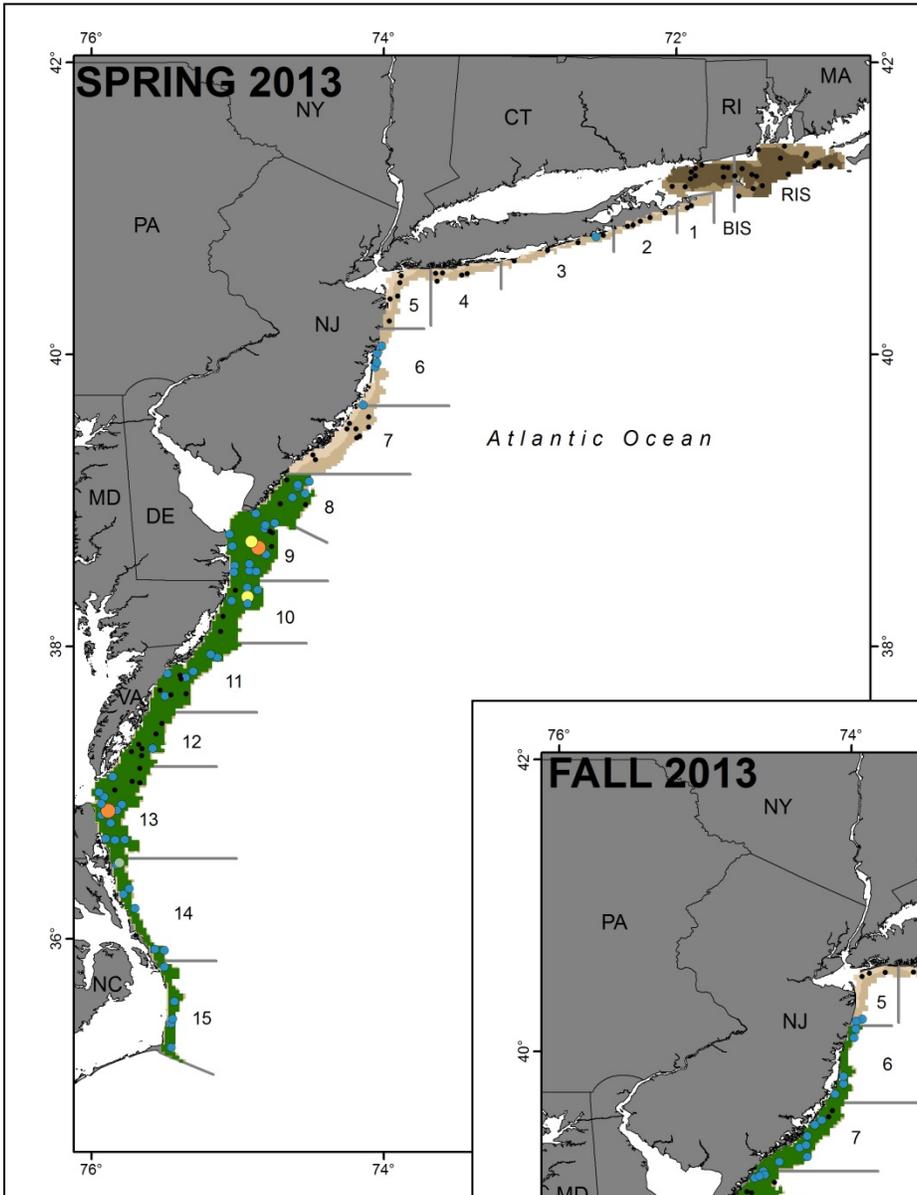
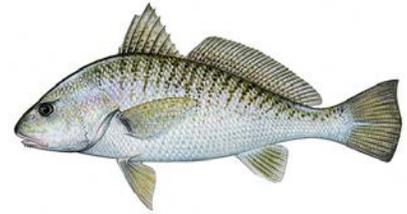
Figure 33. Atlantic Cod diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled).



Atlantic Croaker

Sampling Priority: A

Figure 34. Atlantic Croaker biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	60-90		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 16. Atlantic Croaker sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	467	25.0	212	41	41	38	38
	2009	17,040	1,004.3	1,225	80	78	66	60
	2010	29,365	1,656.2	929	49	49	48	13
	2011	10,576	349.2	890	71	70	62	62
	2012	536	53.5	347	90	0	75	74
	2013	41,571	3,098.7	4,487	297	0	200	193
Fall	2007	58,763	7,616.5	2,843	211	211	194	188
	2008	66,823	5,123.2	3,591	307	307	283	280
	2009	45,730	5,685.3	5,277	415	414	341	291
	2010	73,685	5,715.1	4,095	275	271	217	213
	2011	58,671	6,148.1	5,561	324	323	294	288
	2012	319,363	21,702.4	21,456	415	0	320	293
	2013	97,463	10,425.9	8,574	295	0	202	0

Table 17. Atlantic Croaker geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys (age-specific indices for age-2 and older calculated for fall surveys only).

Spring Survey							Fall Survey										
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								2007	102	11.30	19.51	33.20	4.19	6.66	10.29	
	2008	86	0.21	0.55	1.00	0.02	0.14	0.27	2008	102	6.57	12.33	22.48	1.88	3.28	5.37	
	2009	91	0.56	1.18	2.05	0.17	0.43	0.76	2009	107	17.56	30.42	52.20	4.74	7.52	11.66	
	2010	87	0.12	0.54	1.12	0.00	0.24	0.56	2010	102	4.54	8.31	14.65	1.88	3.17	5.06	
	2011	87	0.42	0.89	1.51	0.12	0.31	0.55	2011	102	12.63	21.52	36.20	3.74	5.87	8.95	
	2012	87	0.51	0.84	1.24	0.07	0.19	0.34	2012	102	46.02	77.23	129.15	8.57	13.14	19.91	
	2013	87	6.76	11.03	17.67	1.53	2.40	3.56	2013	103	6.73	12.52	22.65	1.92	3.38	5.57	
	2014								2014								
0	2007							2007	102	0.74	1.57	2.79	0.27	0.65	1.15		
2008	86	0.00	0.13	0.30	0.00	0.02	0.05	2008	102	4.25	8.09	14.75	1.21	2.19	3.61		
2009	91	0.29	0.58	0.95	0.04	0.15	0.27	2009	107	3.32	5.53	8.88	0.93	1.53	2.30		
2010	87	0.02	0.29	0.63	0.00	0.12	0.29	2010	102	0.67	1.43	2.55	0.24	0.58	1.01		
2011	87	0.17	0.50	0.91	0.03	0.16	0.30	2011	102	1.33	2.22	3.46	0.43	0.72	1.06		
2012	87	0.06	0.17	0.29	0.00	0.02	0.03	2012	102	12.99	21.19	34.19	2.89	4.38	6.45		
2013	87	1.50	2.31	3.37	0.34	0.54	0.77	2013	103	3.96	7.24	12.67	1.20	2.12	3.43		
2014								2014									
2015								2015									
2016								2016									
1	2007							2007	102	5.27	9.00	14.96	2.02	3.23	4.94		
2008	86	0.09	0.34	0.65	0.00	0.08	0.17	2008	102	1.78	3.40	5.95	0.57	1.08	1.76		
2009	91	0.48	1.01	1.73	0.13	0.35	0.62	2009	107	10.81	18.64	31.65	3.22	5.11	7.85		
2010	87	0.08	0.47	0.99	0.00	0.21	0.50	2010	102	2.15	3.98	6.88	0.90	1.58	2.51		
2011	87	0.33	0.74	1.28	0.09	0.26	0.46	2011	102	8.32	14.25	23.95	2.58	4.09	6.24		
2012	87	0.34	0.57	0.85	0.03	0.12	0.21	2012	102	32.69	54.28	89.70	6.27	9.56	14.33		
2013	87	4.15	6.82	10.88	1.00	1.61	2.40	2013	103	4.03	7.26	12.57	1.17	2.07	3.34		
2014								2014									
2015								2015									
2016								2016									
2	2007							2007	102	3.37	5.54	8.78	1.30	2.03	2.99		
2008	86	0.07	0.26	0.48	0.00	0.06	0.12	2008	102	1.46	2.66	4.44	0.48	0.88	1.39		
2009	91	0.26	0.64	1.13	0.05	0.22	0.43	2009	107	2.07	3.14	4.58	0.65	0.96	1.33		
2010	87	0.03	0.35	0.77	0.00	0.15	0.38	2010	102	2.69	4.72	7.87	1.09	1.80	2.75		
2011	87	0.19	0.43	0.72	0.05	0.12	0.19	2011	102	4.63	7.33	11.31	1.40	2.09	2.99		
2012	87	0.17	0.37	0.61	0.00	0.09	0.18	2012	102	6.89	10.48	15.71	1.30	1.95	2.78		
2013	87	2.54	4.09	6.34	0.57	0.98	1.49	2013	103	1.86	3.26	5.36	0.52	0.98	1.57		
2014								2014									
2015								2015									
2016								2016									
3	2007							2007	102	2.48	3.57	5.00	1.06	1.48	1.98		
2008	86	0.03	0.13	0.25	0.00	0.03	0.07	2008	102	0.33	0.64	1.01	0.12	0.26	0.42		
2009	91	0.11	0.37	0.68	0.00	0.12	0.25	2009	107	1.77	2.65	3.81	0.61	0.90	1.23		
2010	87	0.00	0.21	0.51	0.00	0.09	0.26	2010	102	1.18	1.87	2.78	0.43	0.67	0.93		
2011	87	0.02	0.13	0.25	0.00	0.03	0.07	2011	102	2.66	4.00	5.84	0.78	1.13	1.56		
2012	87	0.06	0.21	0.37	0.00	0.05	0.12	2012	102	1.47	2.25	3.26	0.28	0.50	0.75		
2013	87	0.92	1.58	2.46	0.20	0.44	0.73	2013	103	0.59	1.11	1.79	0.14	0.35	0.59		
2014								2014									
2015								2015									
2016								2016									
4+	2007							2007	102	1.85	2.58	3.51	0.84	1.16	1.54		
2008	86	0.00	0.07	0.14	0.00	0.01	0.03	2008	102	0.33	0.59	0.90	0.14	0.26	0.41		
2009	91	0.02	0.17	0.34	0.00	0.05	0.10	2009	107	1.04	1.56	2.20	0.36	0.55	0.76		
2010	87	0.00	0.11	0.29	0.00	0.04	0.13	2010	102	1.09	1.67	2.42	0.41	0.62	0.86		
2011	87	0.00	0.05	0.11	0.00	0.01	0.02	2011	102	1.22	1.78	2.49	0.33	0.48	0.66		
2012	87	0.00	0.09	0.19	0.00	0.02	0.06	2012	102	0.53	0.87	1.27	0.09	0.22	0.36		
2013	87	0.51	0.92	1.45	0.20	0.40	0.64	2013	103	0.27	0.57	0.94	0.06	0.19	0.33		
2014								2014									
2015								2015									
2016								2016									

Figure 35. Atlantic Croaker geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys

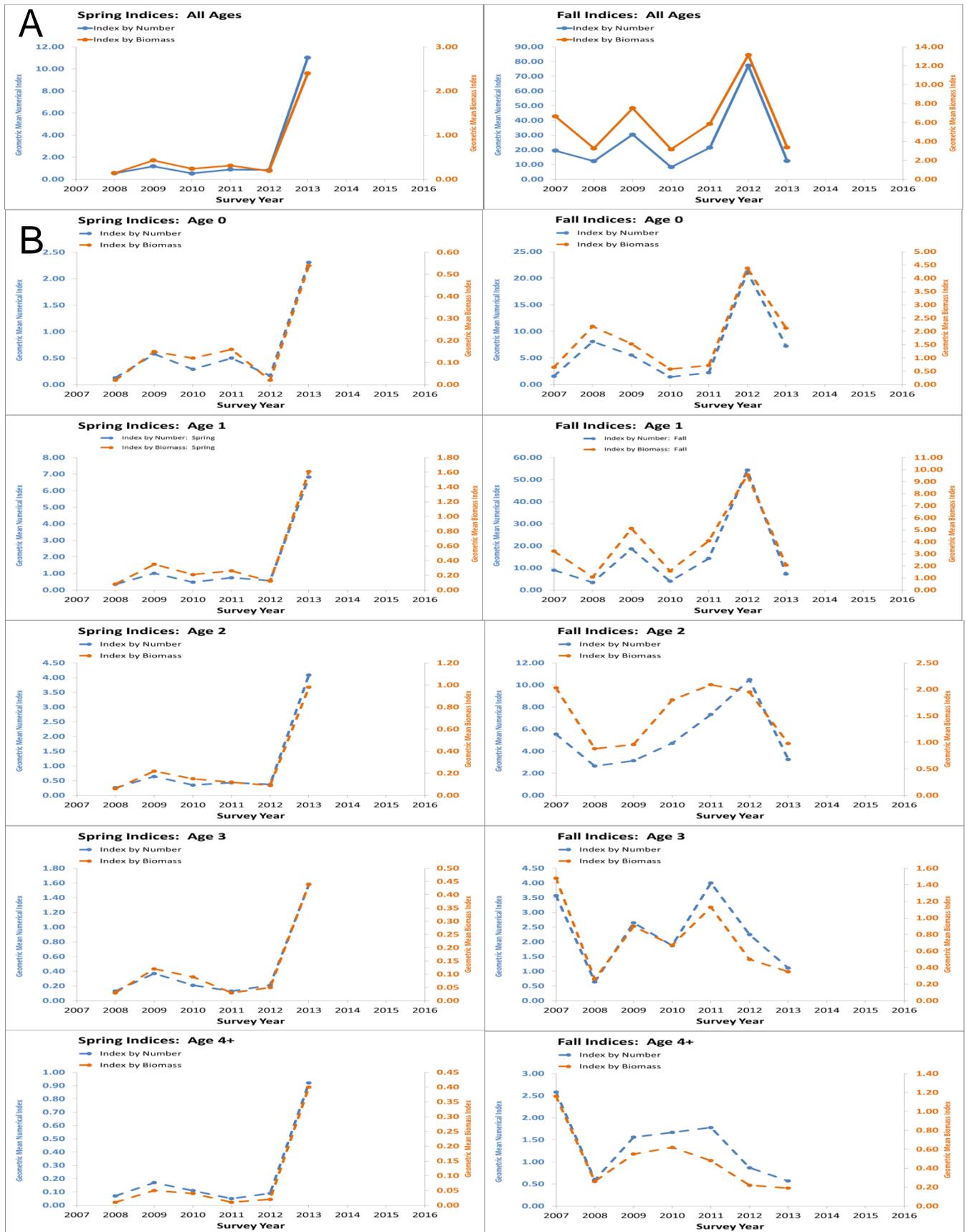


Figure 36. Atlantic Croaker length-frequency distributions, by cruise.

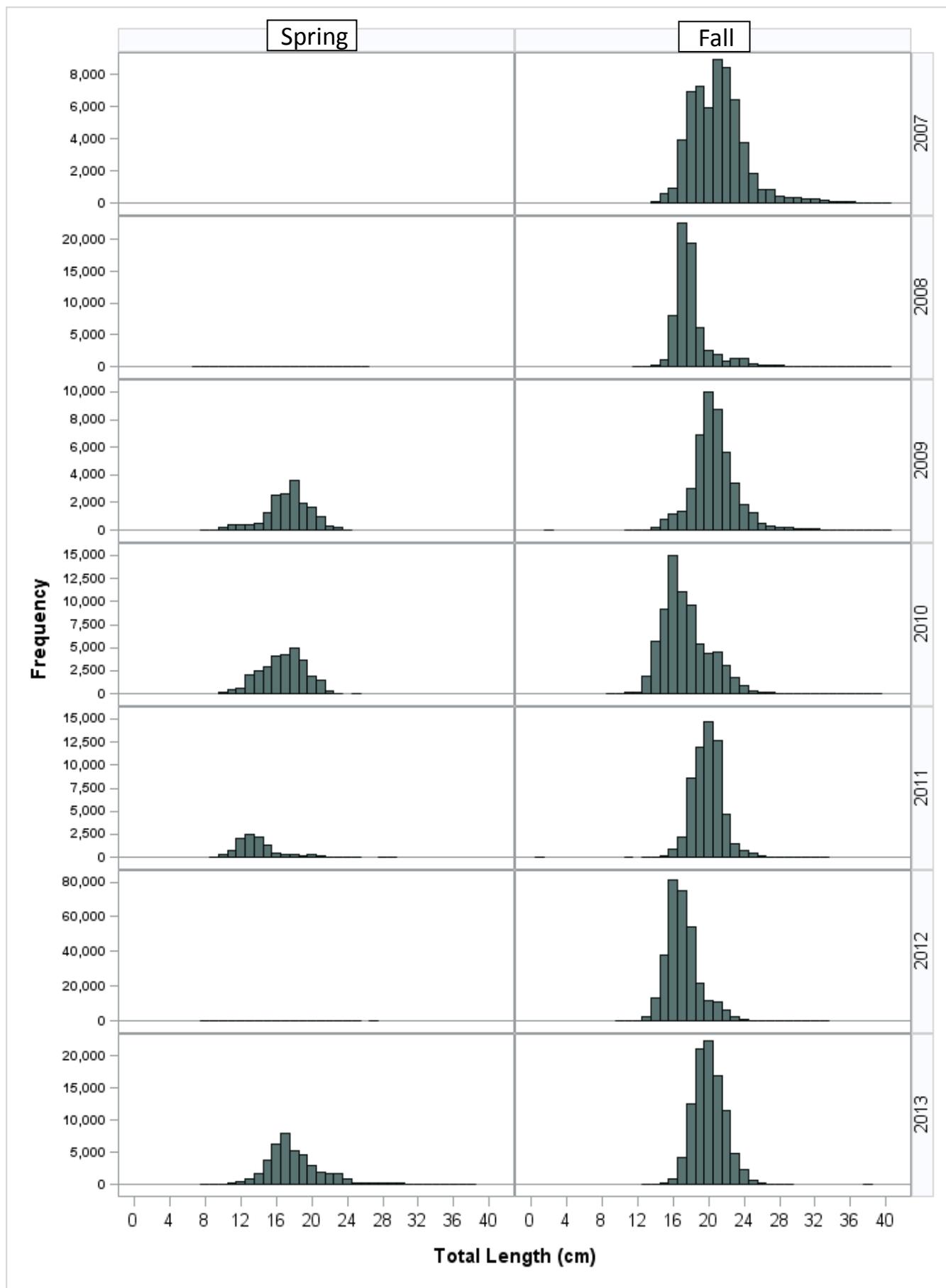


Figure 37. Atlantic Croaker length-frequency distributions, by cruise and sex.

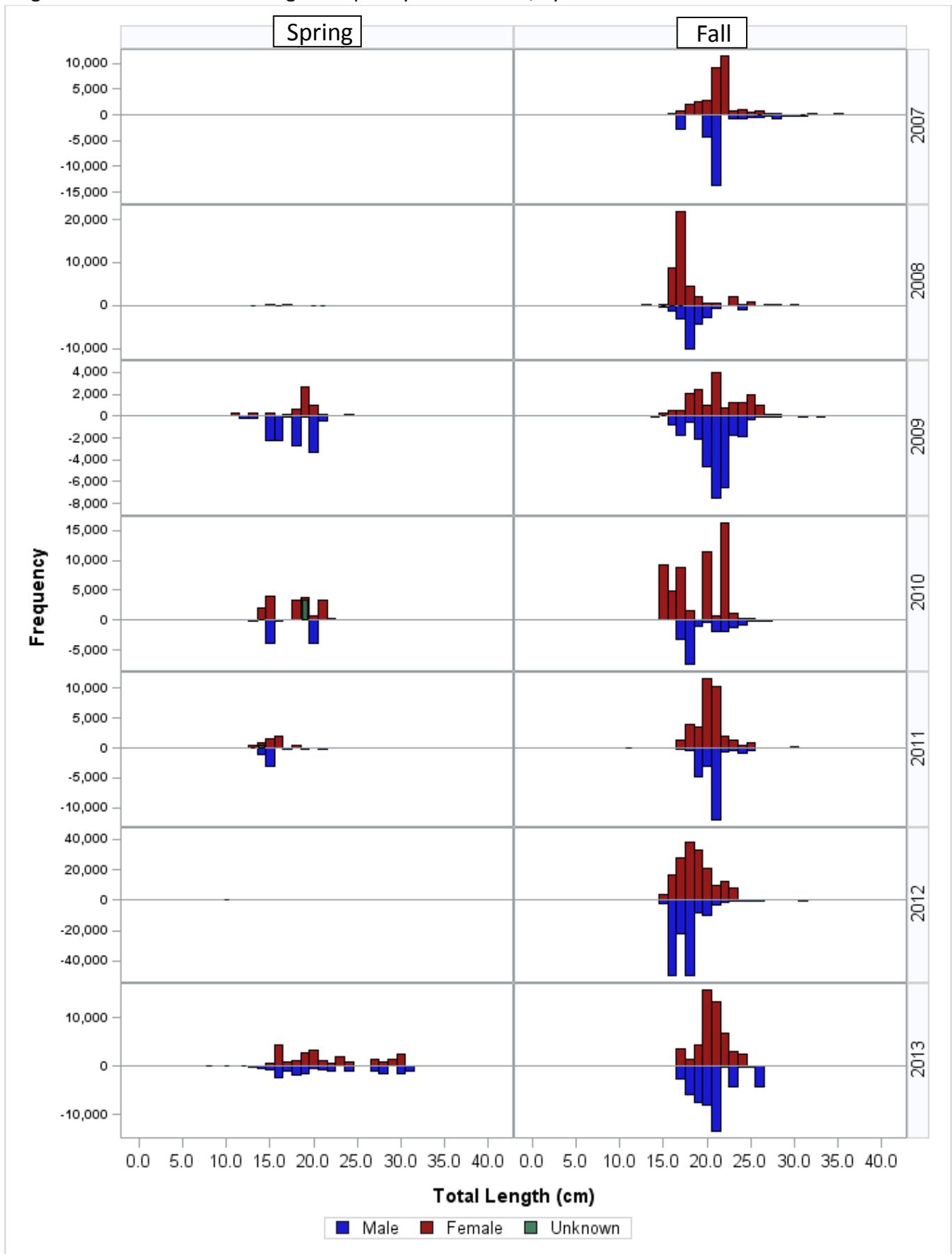


Figure 38. Atlantic Croaker age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

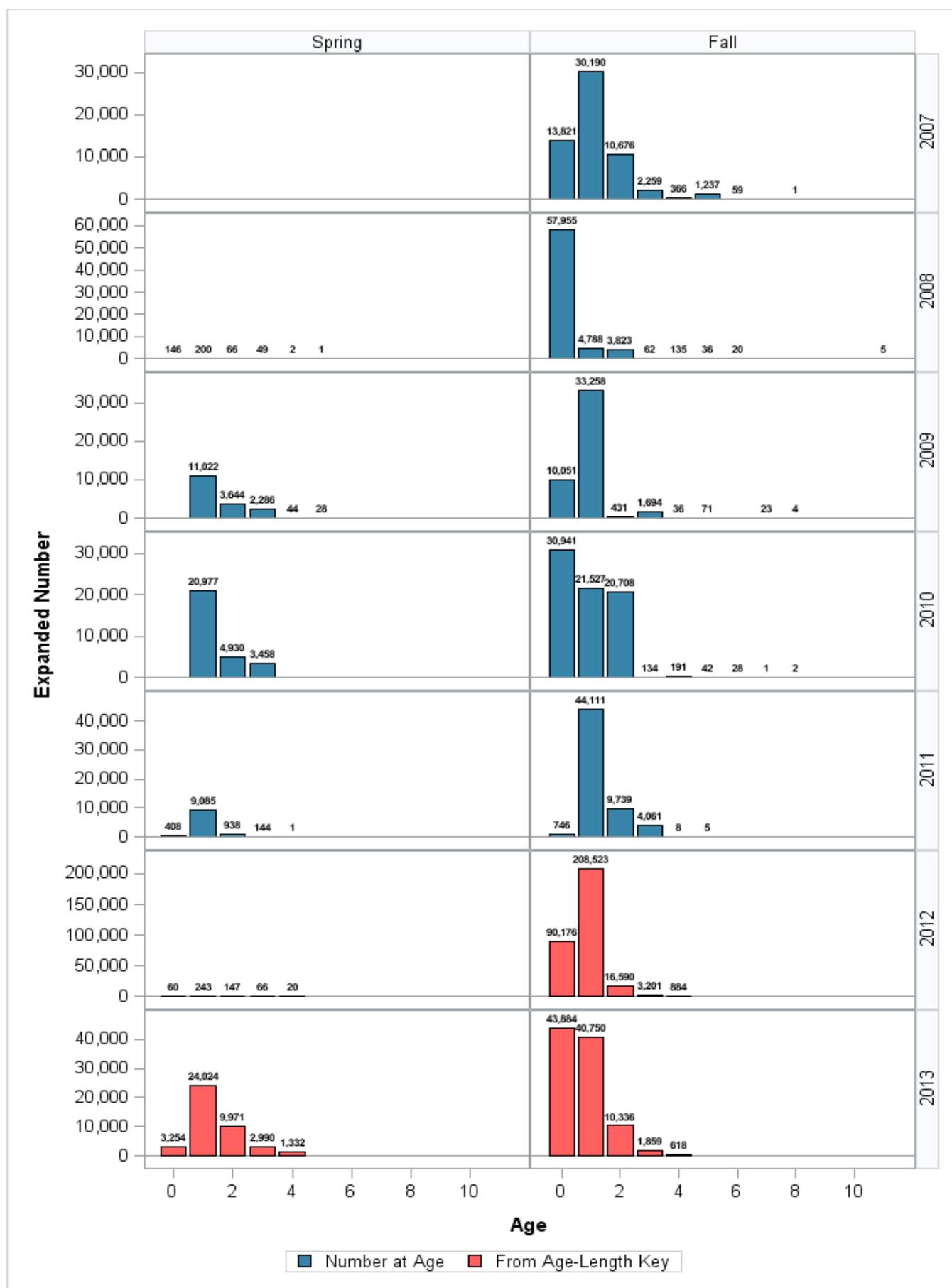


Figure 39. Atlantic Croaker catch-at-age standardized to 3,000 trawl minutes, by cruise.



Figure 40. Atlantic Croaker sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

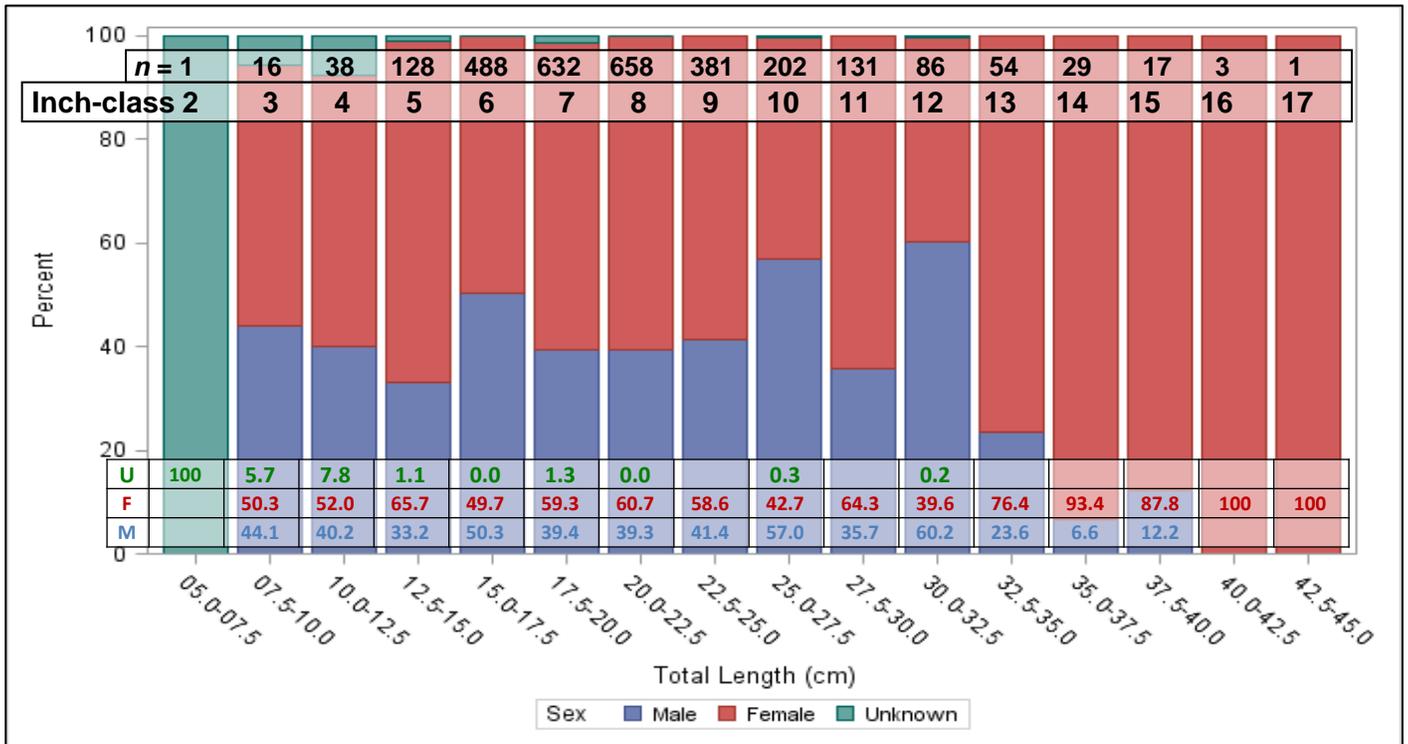


Figure 41. Atlantic Croaker maturity at length, by sex for all cruises pooled, 2007-2013.

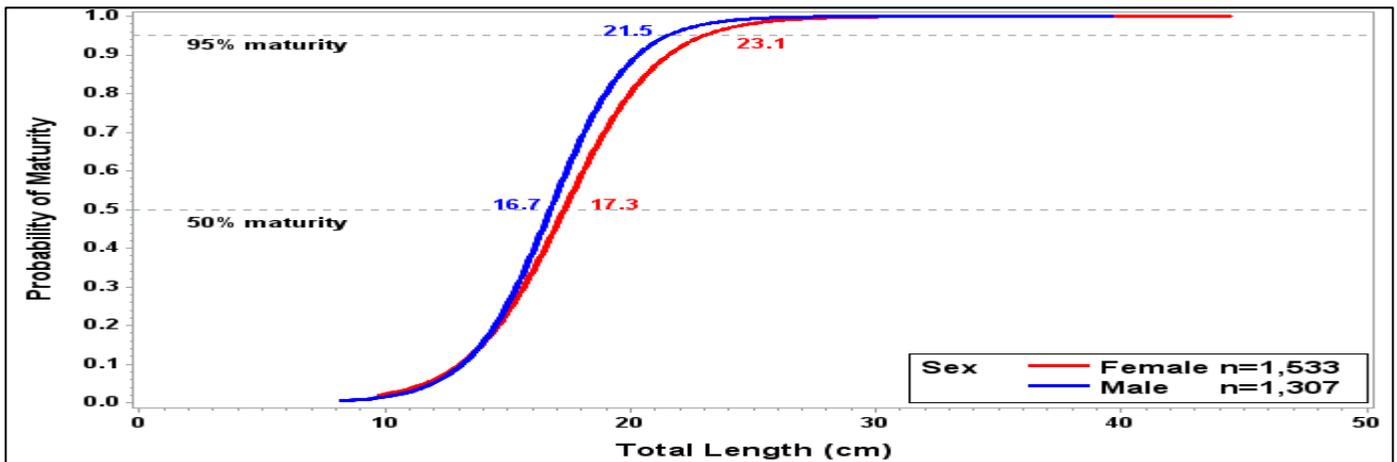


Figure 42. Atlantic Croaker maturity at age, by sex for all cruises pooled, 2007-2013.

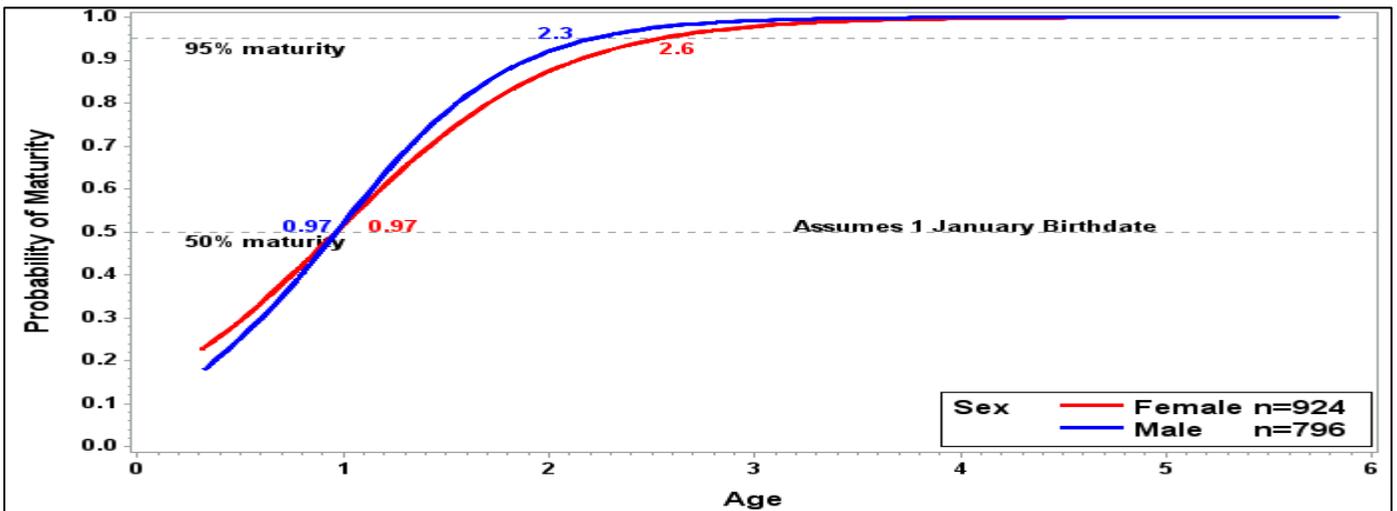
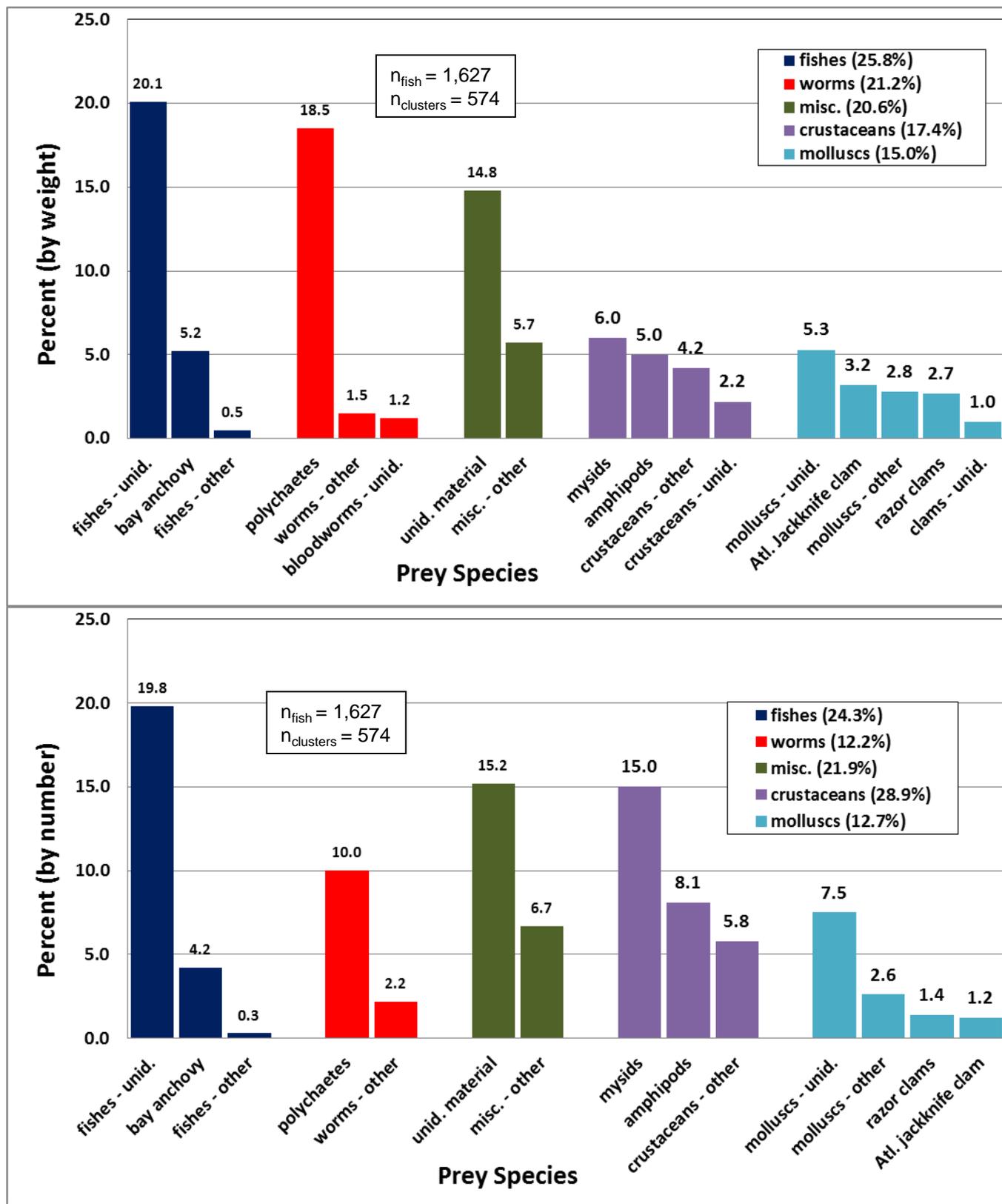


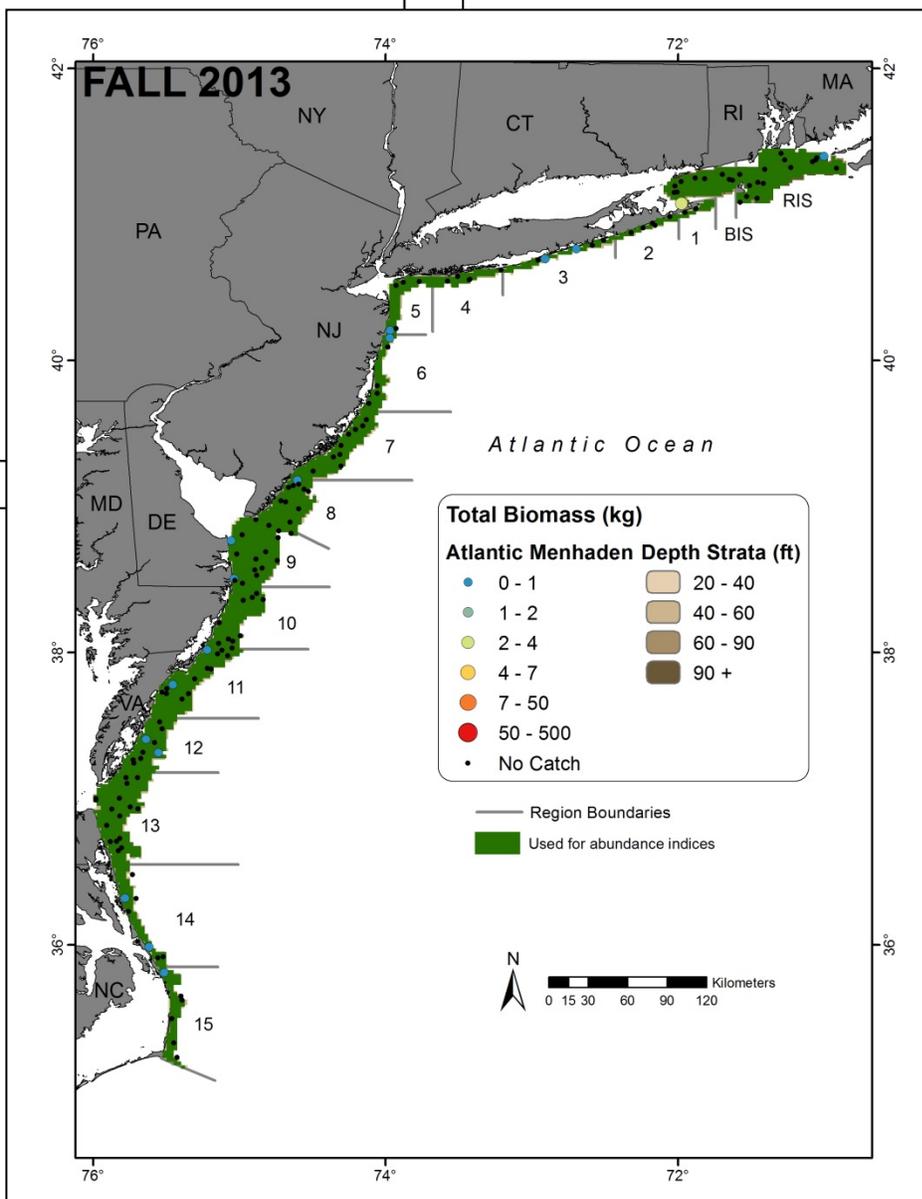
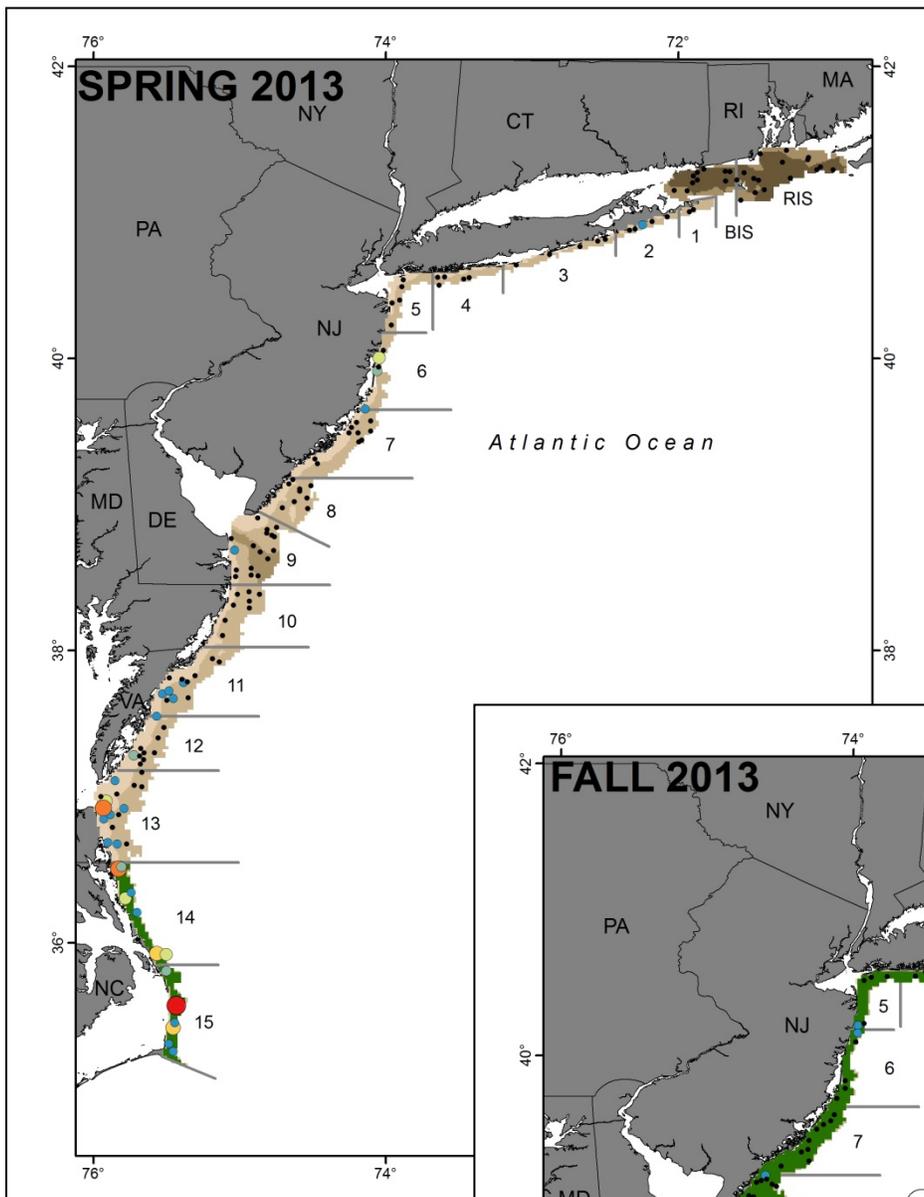
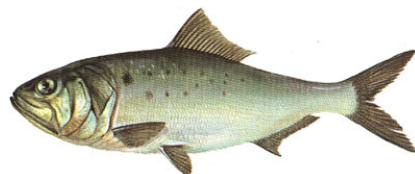
Figure 43. Atlantic Croaker diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Atlantic Menhaden

Sampling Priority: A

Figure 44. Atlantic Menhaden biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
MD	10	20-40		
	10	40-60		
VA	11	20-40		
	12	40-60		
	12	20-40		
NC	14	20-40		
	15	40-60		
		20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 18. Atlantic Menhaden sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	32	2.0	32	10	0	10	0
	2009	24,566	786.0	2,146	78	0	78	0
	2010	8,177	446.1	224	30	0	30	0
	2011	1,564	59.1	328	45	0	45	1
	2012	34	11.6	34	10	0	9	0
	2013	3,181	129.0	943	133	0	133	0
Fall	2007	740	30.2	288	78	0	78	1
	2008	208	25.0	208	68	0	68	0
	2009	146	11.9	146	59	0	58	6
	2010	974	29.3	229	56	0	56	1
	2011	144	19.4	91	54	0	53	0
	2012	73	21.7	73	32	0	30	0
	2013	33	8.1	33	32	0	31	0

Table 19. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	150	0.15	0.29	0.44	0.05	0.09	0.15
	2008	13	0.00	0.25	0.97	0.00	0.08	0.26	2008	150	0.12	0.19	0.27	0.04	0.07	0.10	
	2009	15	4.52	32.06	196.86	0.74	4.27	15.00	2009	160	0.09	0.18	0.27	0.02	0.05	0.08	
	2010	13	0.07	6.75	54.87	0.00	1.89	9.16	2010	150	0.13	0.24	0.37	0.03	0.07	0.12	
	2011	13	0.11	1.22	3.47	0.02	0.31	0.67	2011	150	0.11	0.23	0.35	0.03	0.07	0.12	
	2012	13	0.00	0.00	0.00	0.00	0.00	0.00	2012	150	0.07	0.17	0.27	0.01	0.07	0.12	
	2013	13	9.88	35.32	120.17	0.54	2.32	6.15	2013	150	0.05	0.10	0.16	0.01	0.04	0.06	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	150	0.04	0.14	0.25	0.00	0.02	0.05
	2008								2008	150	0.03	0.08	0.13	0.00	0.02	0.04	
	2009								2009	160	0.02	0.08	0.14	0.00	0.01	0.02	
	2010								2010	150	0.05	0.14	0.23	0.00	0.03	0.06	
	2011								2011	150	0.00	0.07	0.14	0.00	0.01	0.03	
	2012								2012	150	0.00	0.02	0.04	0.00	0.00	0.00	
	2013								2013	150	0.00	0.02	0.04	0.00	0.00	0.00	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007																
	2008	13	0.00	0.00	0.00	0.00	0.00	0.00									
	2009	15	4.11	29.88	185.76	0.71	4.20	14.79									
	2010	13	0.07	6.58	52.57	0.00	1.84	8.82									
	2011	13	0.06	1.15	3.34	0.02	0.30	0.66									
	2012	13	0.00	0.00	0.00	0.00	0.00	0.00									
	2013	13	9.53	34.52	118.88	0.53	2.30	6.13									
	2014																
2015																	
2016																	

Figure 45. Atlantic Menhaden geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

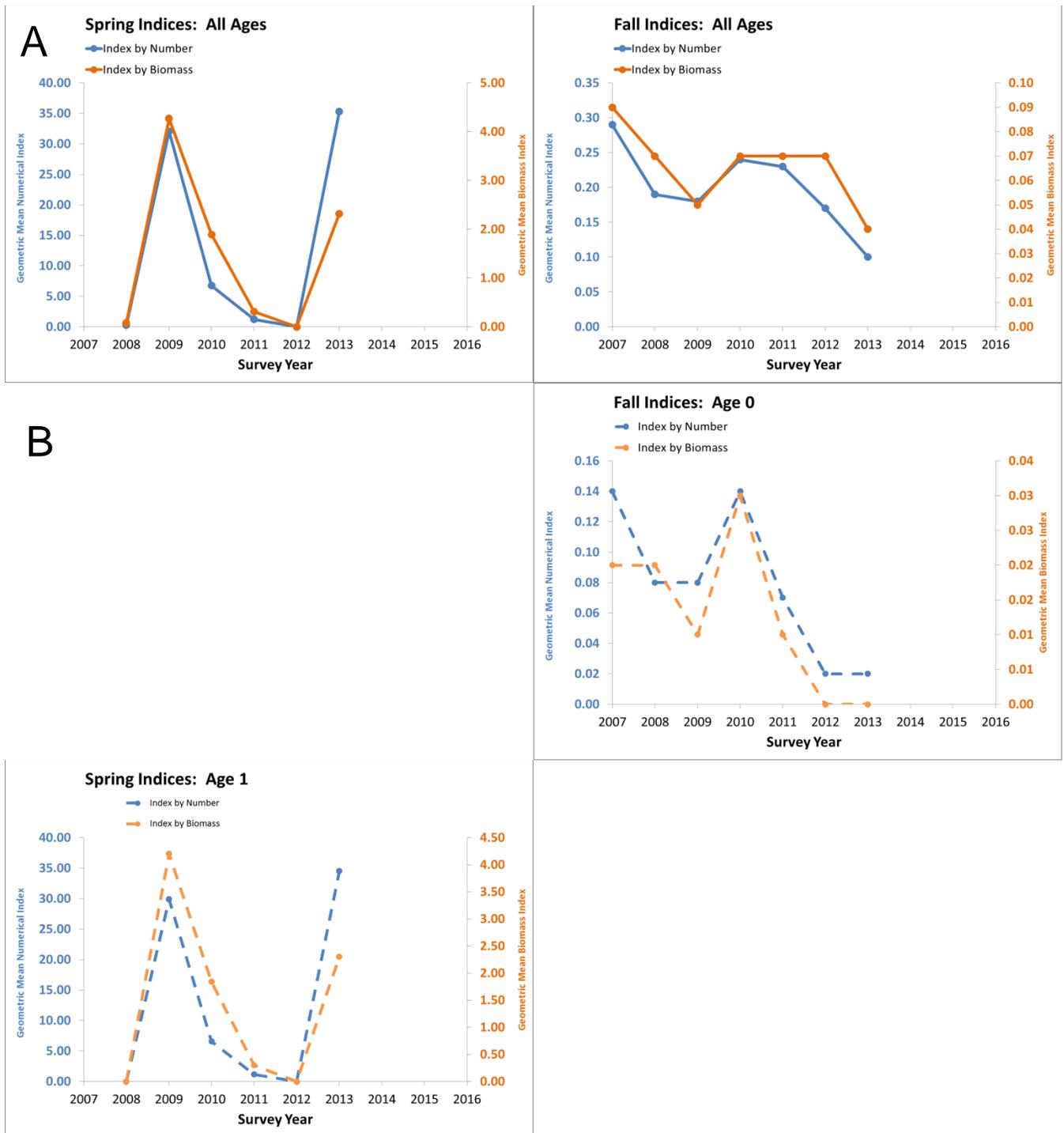


Figure 46. Atlantic Menhaden length-frequency distributions, by cruise (Blue reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values – spring 17cm, fall 15cm - taken from <http://www.asmf.org/speciesDocuments/menhaden/reports/stockAssessments/04MenhadenPeerReviewReport.pdf>).

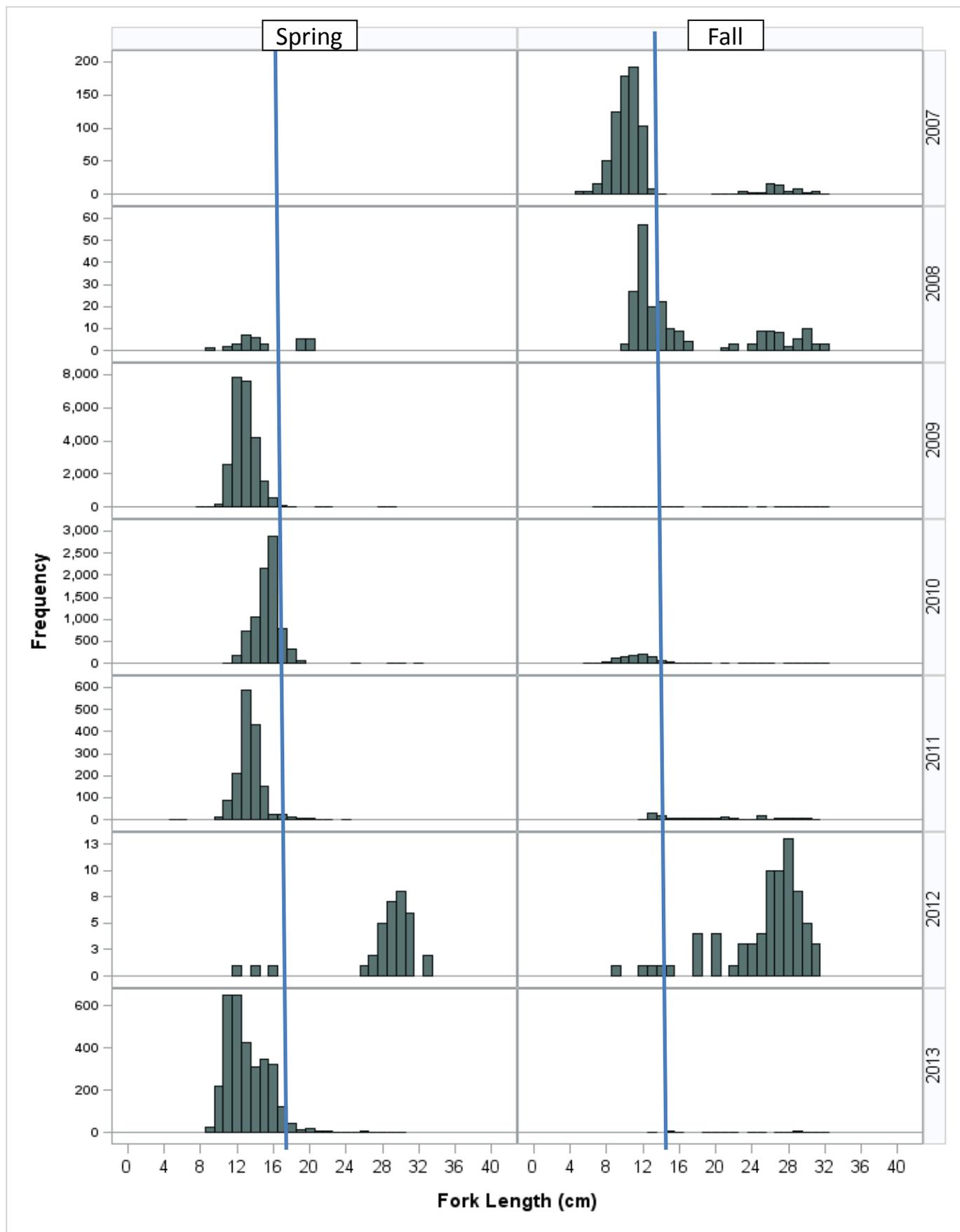


Figure 47. Atlantic Menhaden sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

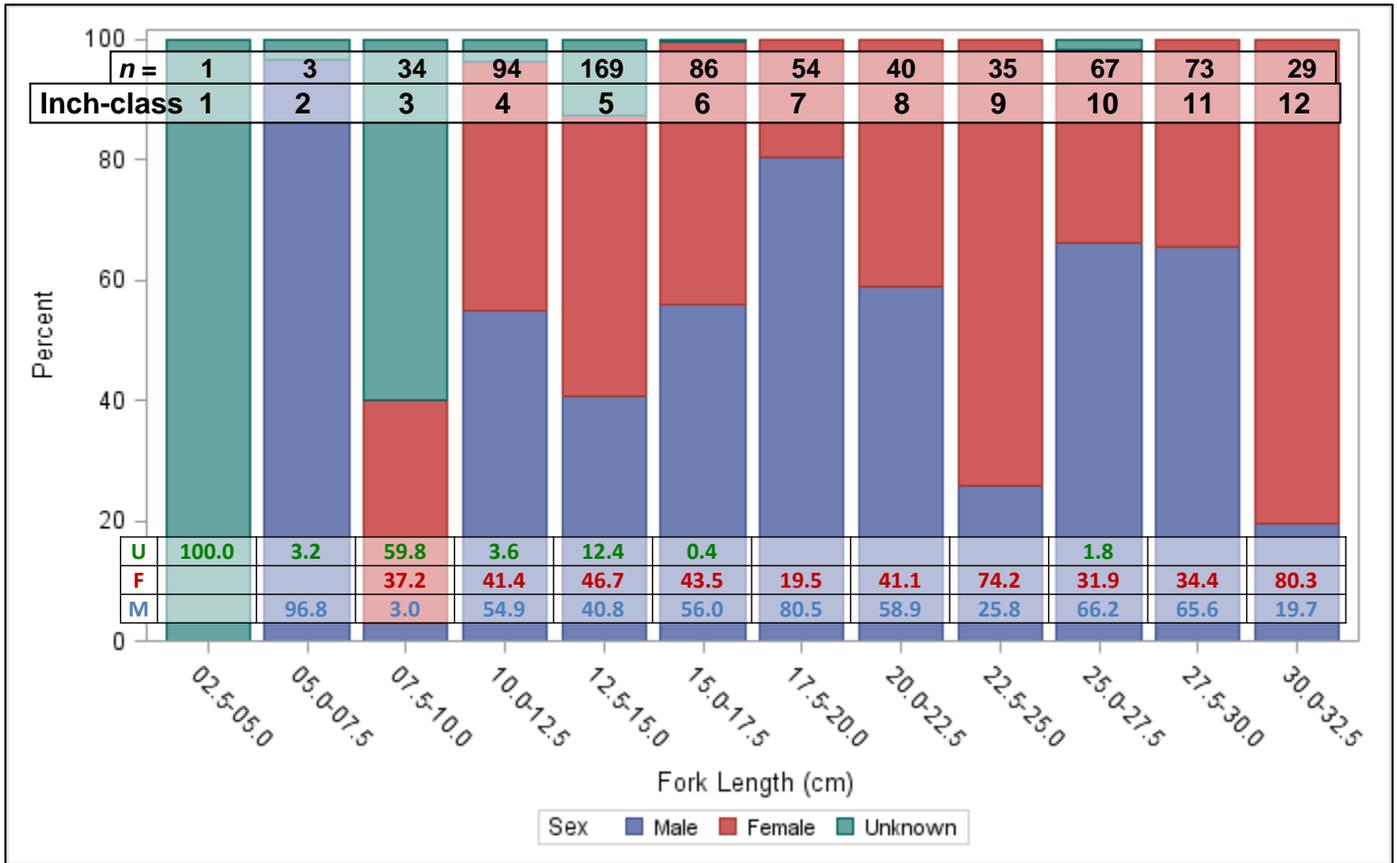
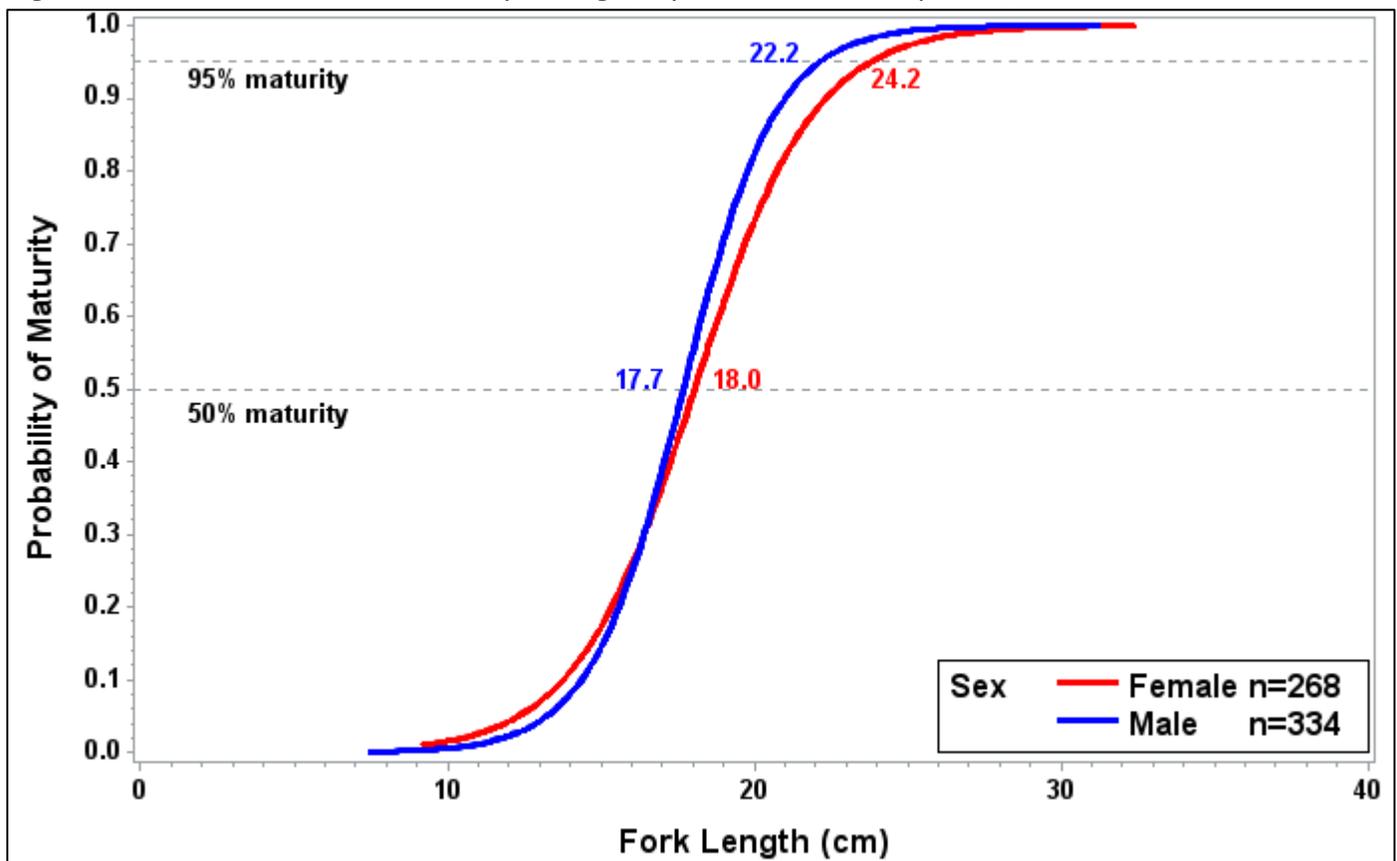


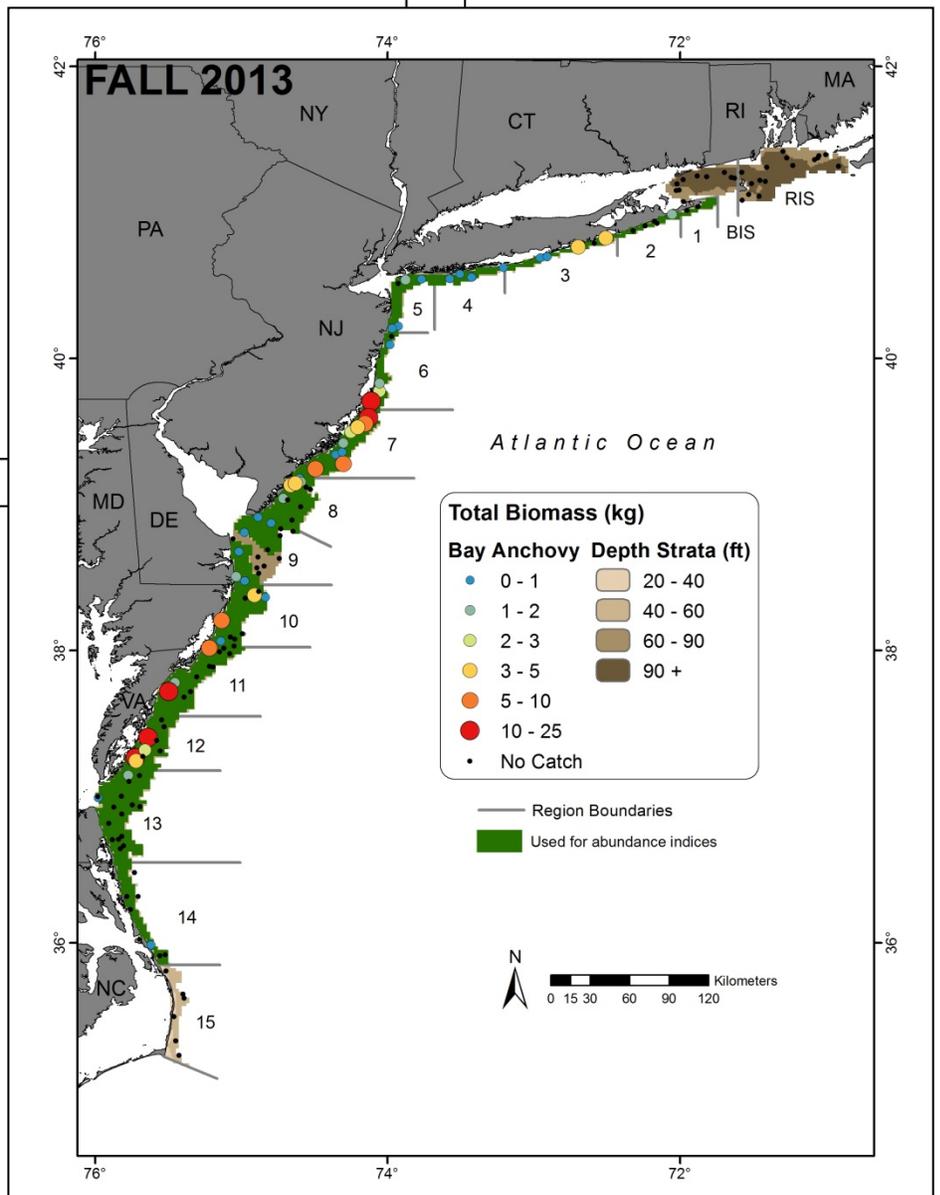
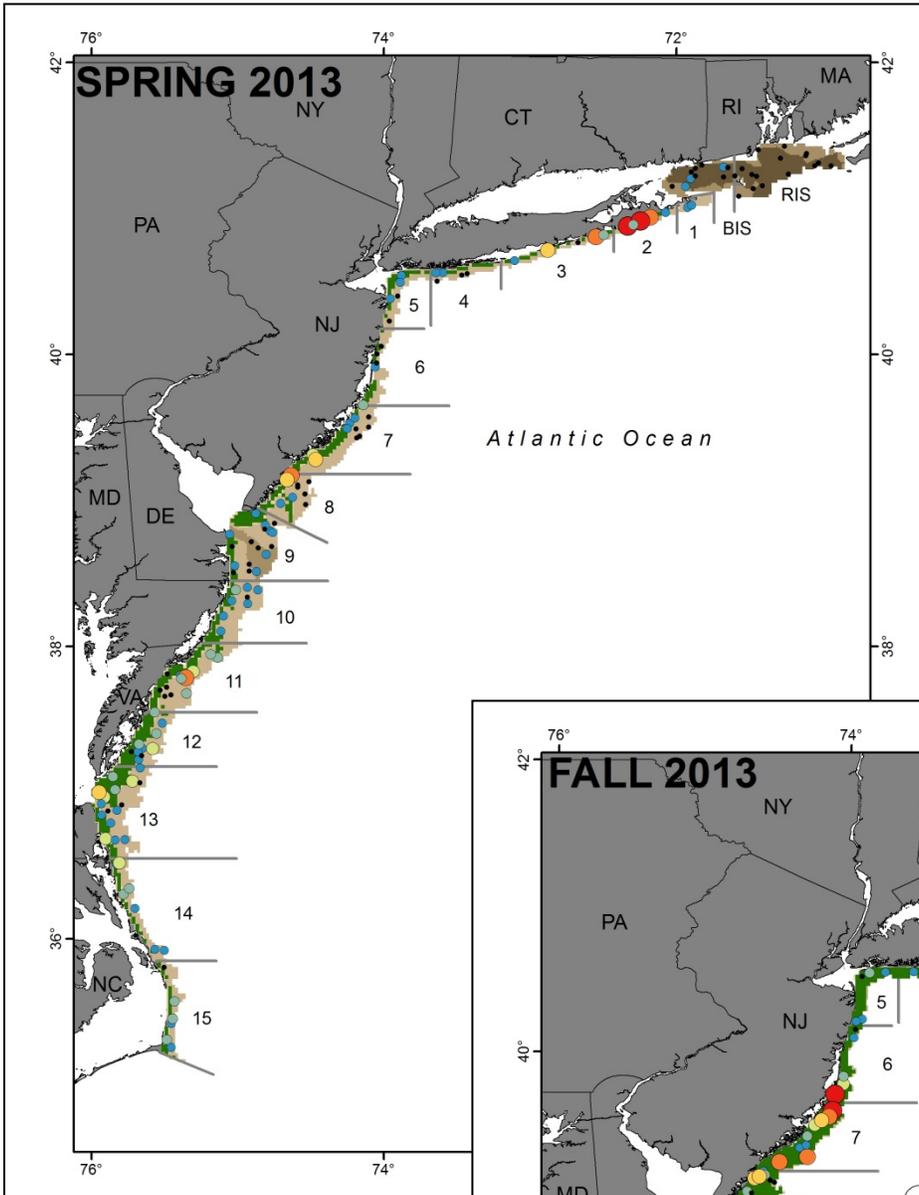
Figure 48. Atlantic Menhaden maturity at length, by sex for all cruises pooled, 2007-2013.



Bay Anchovy

Sampling Priority: D

Figure 49. Bay Anchovy biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
NY	01	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
NJ	06	20-40		
		40-60		
DE	09	20-40		
		40-60		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 20. Bay Anchovy sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	23,926	75.8	3,838	N/A	N/A	N/A	N/A
	2009	62,807	145.9	7,112	N/A	N/A	N/A	N/A
	2010	57,202	175.6	6,143	N/A	N/A	N/A	N/A
	2011	46,807	137.4	5,212	N/A	N/A	N/A	N/A
	2012	18,330	51.4	4,381	N/A	N/A	N/A	N/A
	2013	59,035	189.1	9,741	N/A	N/A	N/A	N/A
Fall	2007	119,741	203.4	3,961	N/A	N/A	N/A	N/A
	2008	35,557	73.4	2,362	N/A	N/A	N/A	N/A
	2009	48,934	177.7	4,527	N/A	N/A	N/A	N/A
	2010	49,991	124.7	4,614	N/A	N/A	N/A	N/A
	2011	33,401	100.0	3,311	N/A	N/A	N/A	N/A
	2012	21,796	62.0	2,519	N/A	N/A	N/A	N/A
	2013	52,635	158.1	7,631	N/A	N/A	N/A	N/A

Table 21. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey										Fall Survey									
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index				
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI		
All	2007								All	2007	118	10.23	17.18	28.44	0.50	0.69	0.91		
	2008	43	28.83	62.07	132.39	0.44	0.72	1.04		2008	113	4.85	8.88	15.67	0.20	0.32	0.44		
	2009	51	57.63	129.60	289.91	0.79	1.14	1.57		2009	122	9.62	15.38	24.25	0.38	0.53	0.70		
	2010	42	32.97	69.49	145.27	0.69	1.10	1.61		2010	113	12.93	21.78	36.25	0.43	0.56	0.72		
	2011	42	11.48	34.12	97.85	0.42	0.77	1.21		2011	113	3.44	6.28	10.93	0.23	0.35	0.49		
	2012	42	9.77	22.85	51.82	0.20	0.46	0.77		2012	113	0.95	1.63	2.53	0.10	0.16	0.22		
	2013	43	144.67	259.39	464.47	1.12	1.48	1.90		2013	113	8.55	14.36	23.69	0.43	0.63	0.86		
	2014									2014									
	2015									2015									
	2016									2016									

Figure 50. Bay Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

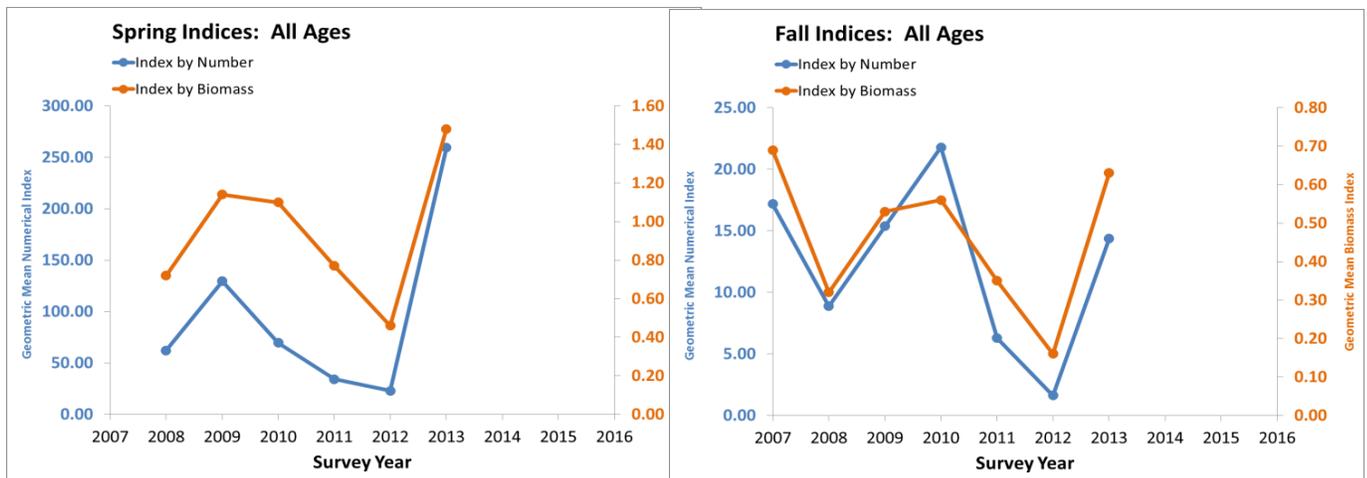
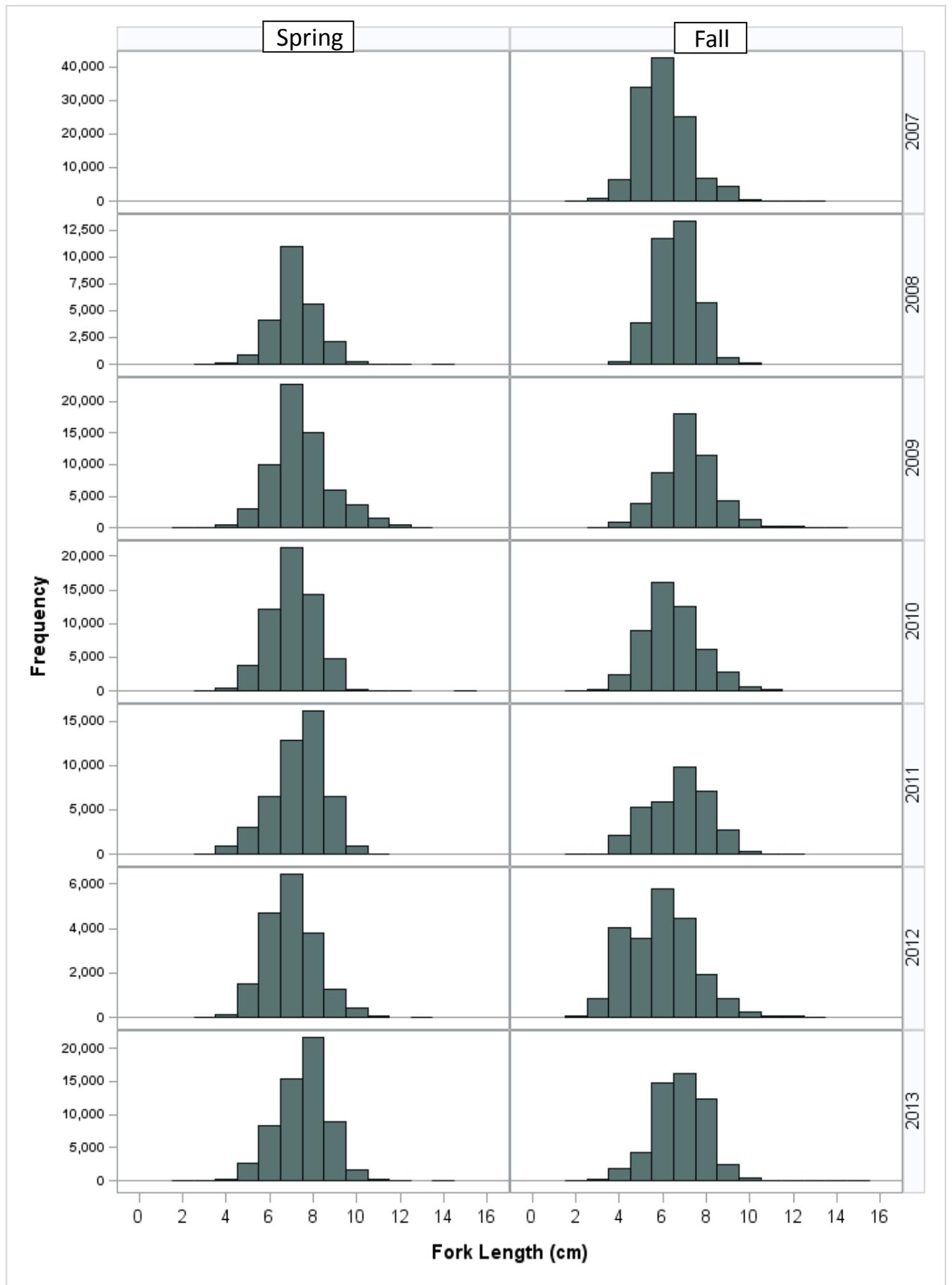


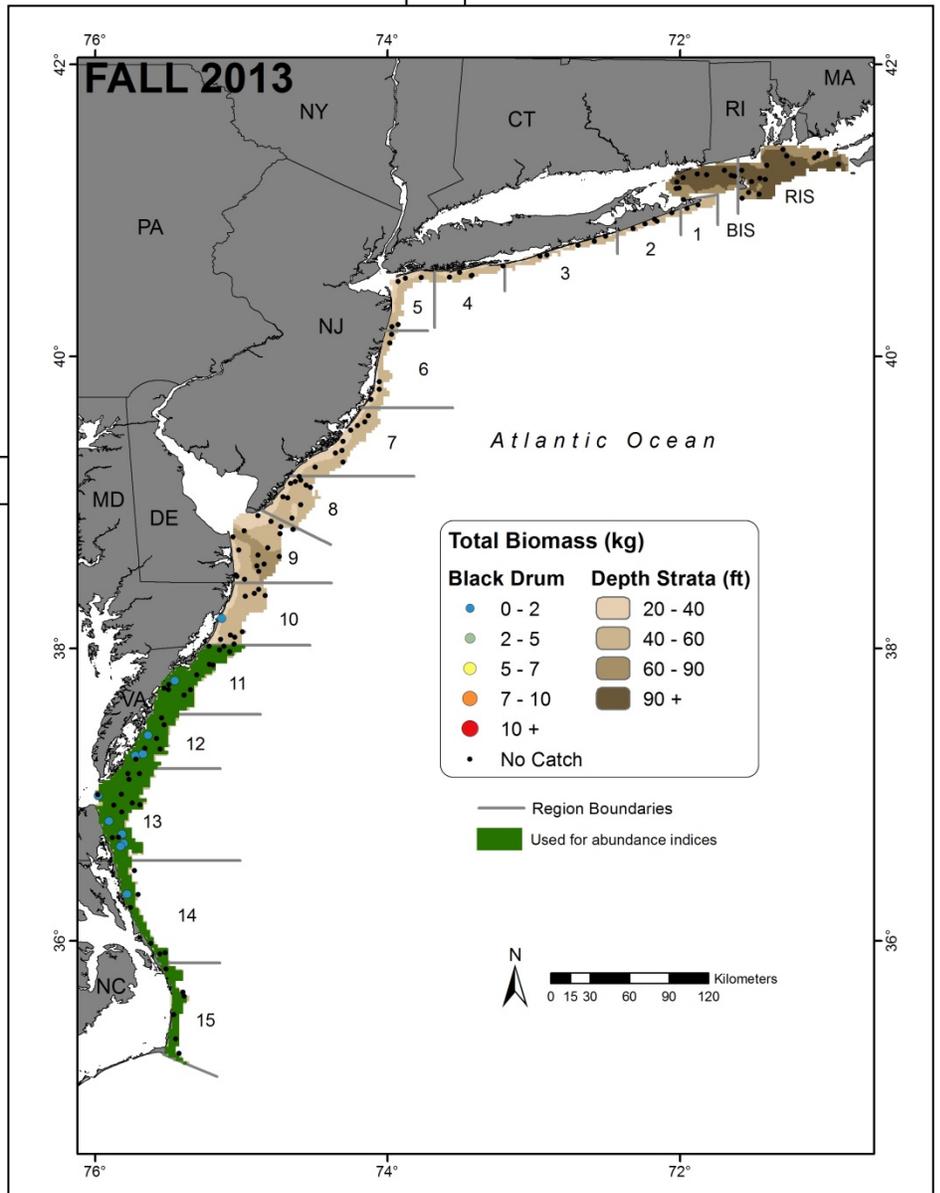
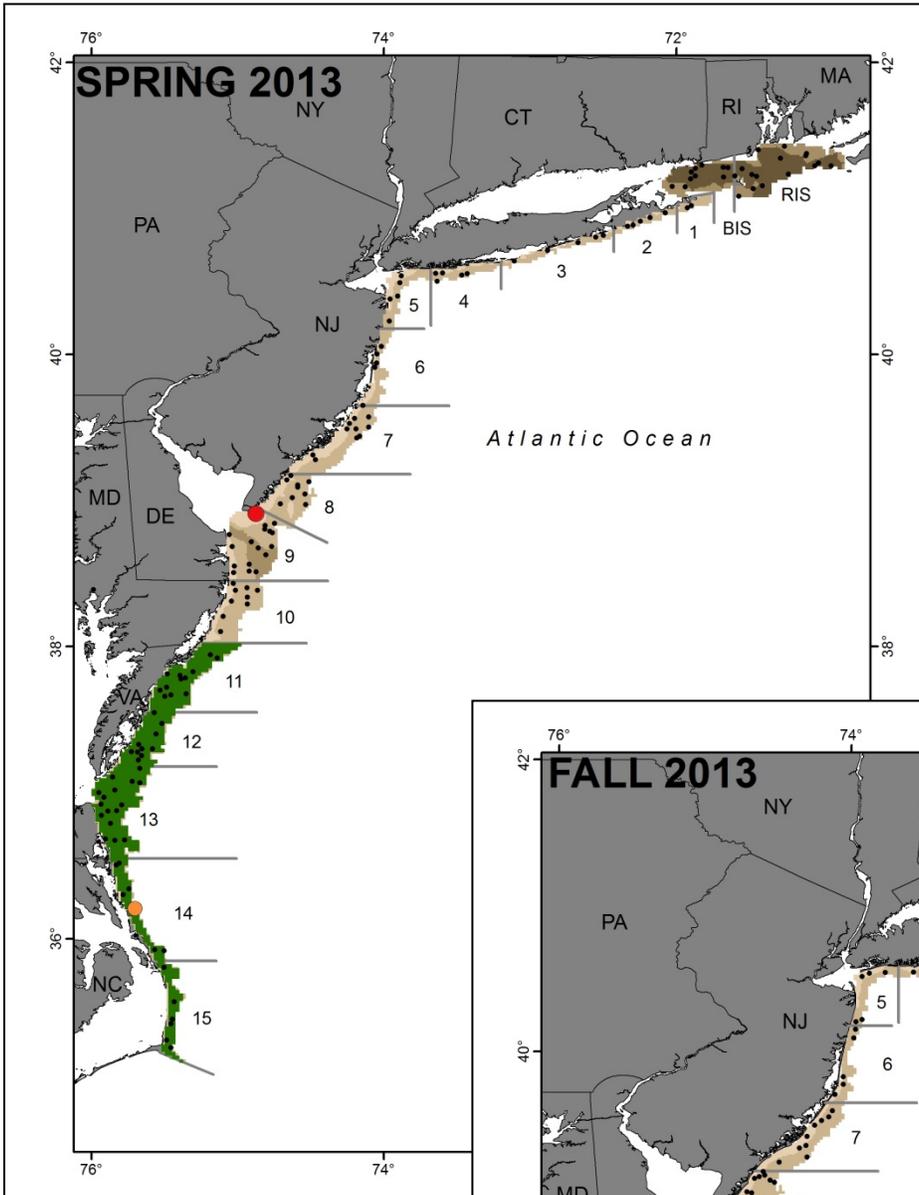
Figure 51. Bay Anchovy length-frequency distributions, by cruise.



Black Drum

Sampling Priority: A

Figure 52. Black Drum biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index	
RI	RIS	60-90			
		90+			
NY	BIS	60-90			
		90+			
		01	40-60		
		02	20-40		
NJ		40-60			
		03	20-40		
		04	40-60		
		05	20-40		
		06	40-60		
DE		20-40			
		40-60			
		60-90			
MD		20-40			
		40-60			
VA		11	20-40	■	
			40-60	■	
		12	20-40	■	
			40-60	■	
NC		13	20-40	■	
			40-60	■	
		14	20-40	■	
		40-60	■		
		15	20-40	■	
			40-60	■	

■ used for abundance indices
 □ not used for abundance indices

Table 22. Black Drum sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	5	140.9	5	5	5	0	0
	2009	-	0.0	0	0	0	0	0
	2010	-	0.0	0	0	0	0	0
	2011	-	0.0	0	0	0	0	0
	2012	1	18.4	1	1	1	0	0
	2013	2	29.9	2	2	0	2	1
Fall	2007	35	5.8	35	33	33	26	24
	2008	25	2.5	25	22	22	18	18
	2009	66	8.5	66	63	63	28	27
	2010	12	2.3	12	11	11	4	4
	2011	50	30.9	50	48	48	15	15
	2012	15	3.4	15	15	15	12	12
	2013	19	2.9	19	19	0	5	0

Table 23. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	56	0.08	0.17	0.28	0.02	0.04	0.07
	2008	55	0.00	0.04	0.08	0.00	0.16	0.37		2008	51	0.04	0.16	0.29	0.01	0.03	0.06
	2009	53	0.00	0.00	0.00	0.00	0.00	0.00		2009	53	0.36	0.50	0.66	0.07	0.10	0.13
	2010	51	0.00	0.00	0.00	0.00	0.00	0.00		2010	51	0.02	0.08	0.14	0.00	0.02	0.04
	2011	51	0.00	0.00	0.00	0.00	0.00	0.00		2011	51	0.12	0.26	0.42	0.01	0.15	0.31
	2012	51	0.00	0.00	0.00	0.00	0.00	0.00		2012	51	0.02	0.08	0.15	0.00	0.02	0.03
	2013	51	0.00	0.02	0.05	0.00	0.05	0.16		2013	51	0.06	0.18	0.30	0.01	0.04	0.07
	2014									2014							
	2015									2015							
	2016									2016							

Figure 53. Black Drum geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

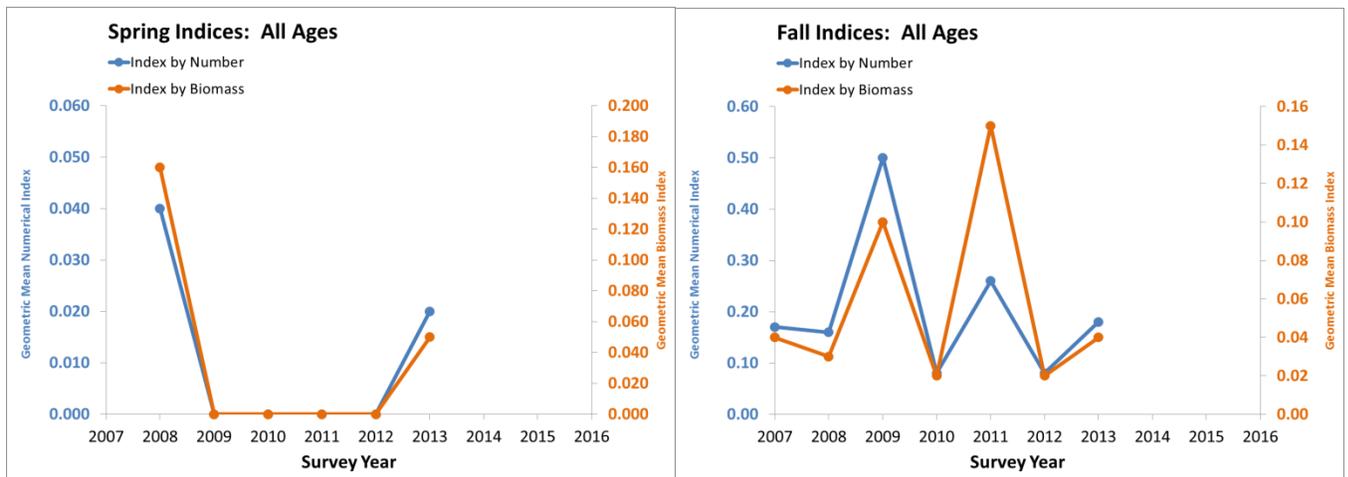


Figure 54. Black Drum length-frequency distributions, by cruise.

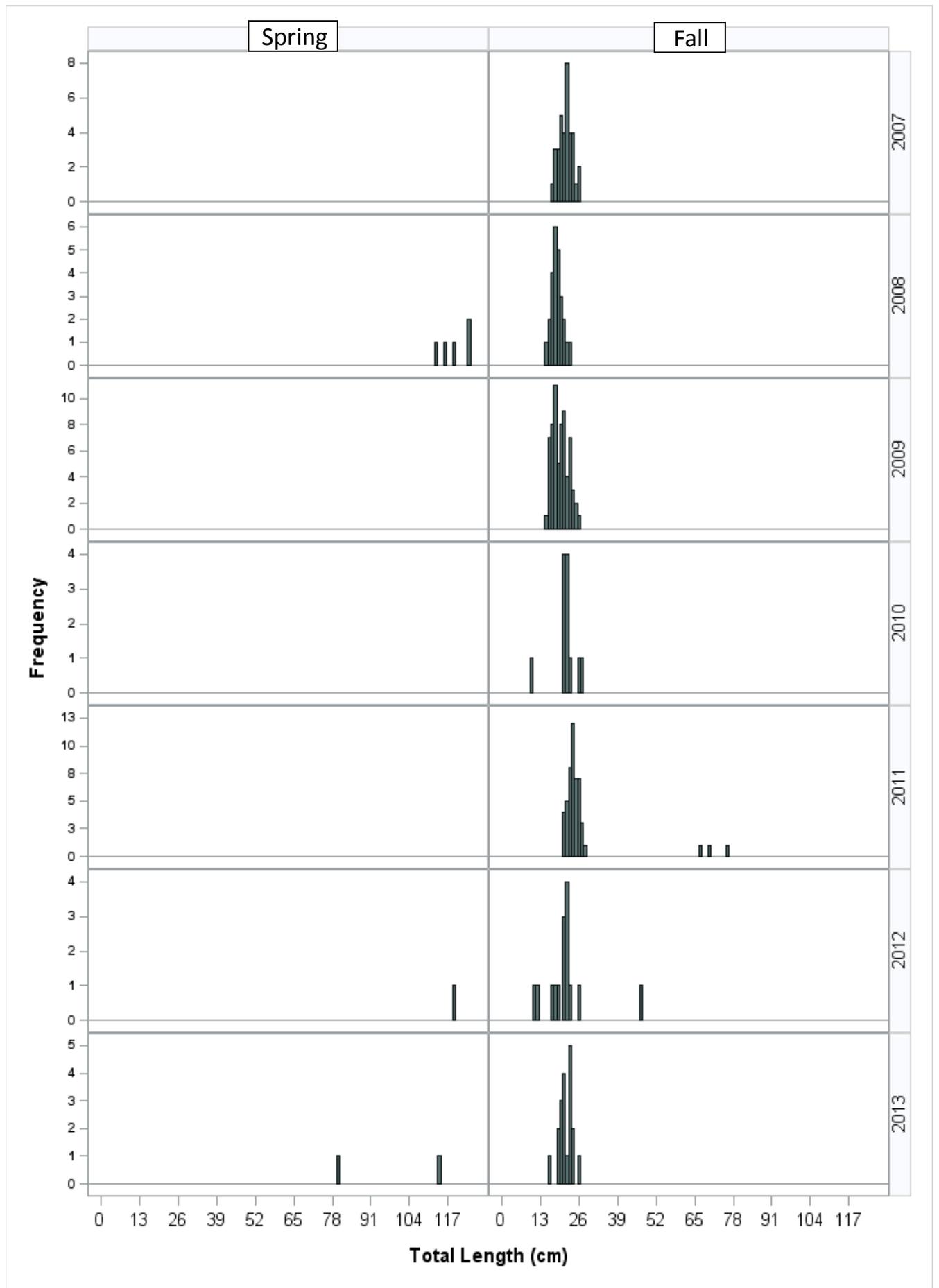


Figure 55. Black Drum age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

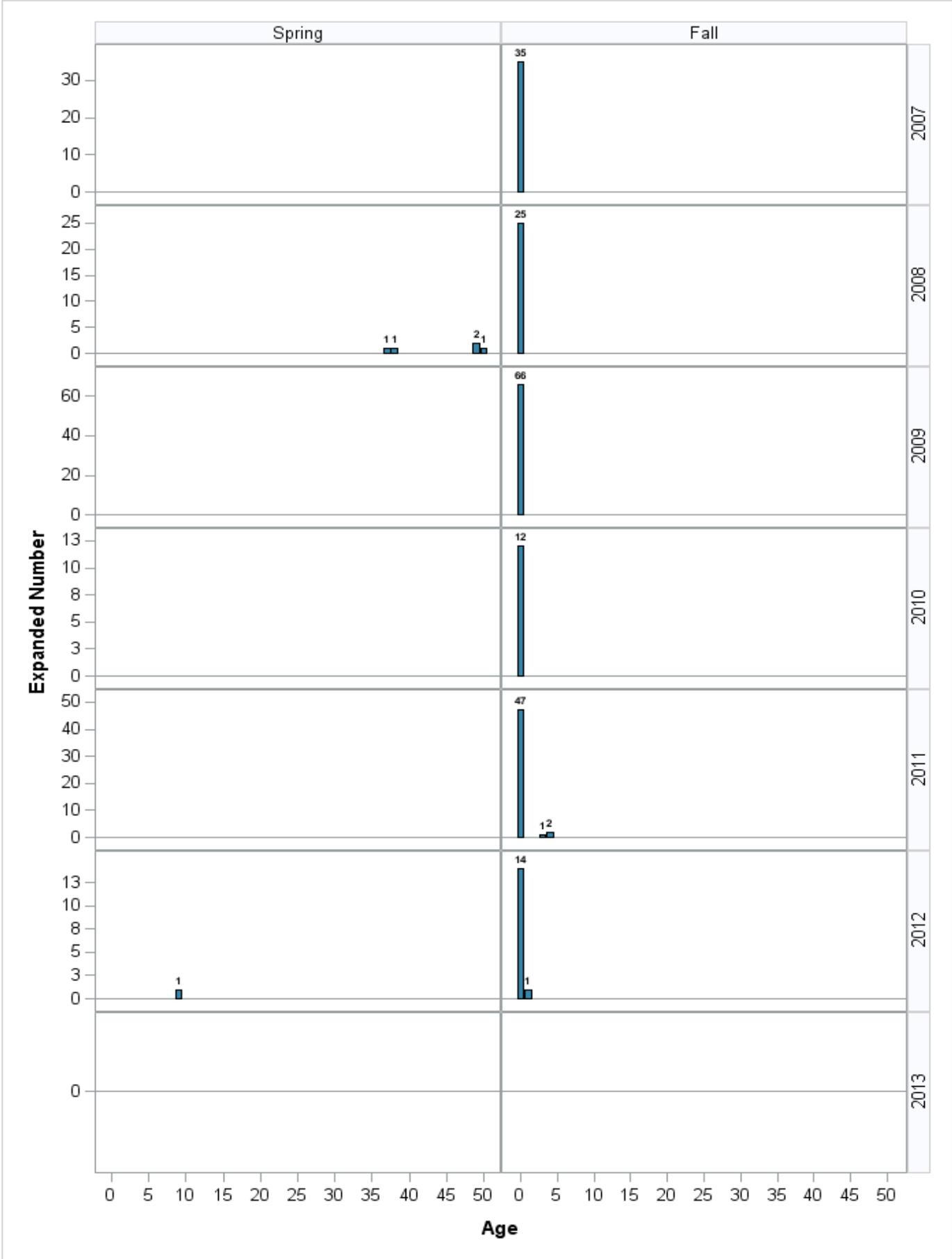


Figure 56. Black Drum catch-at-age standardized to 3,000 trawl minutes, by cruise.

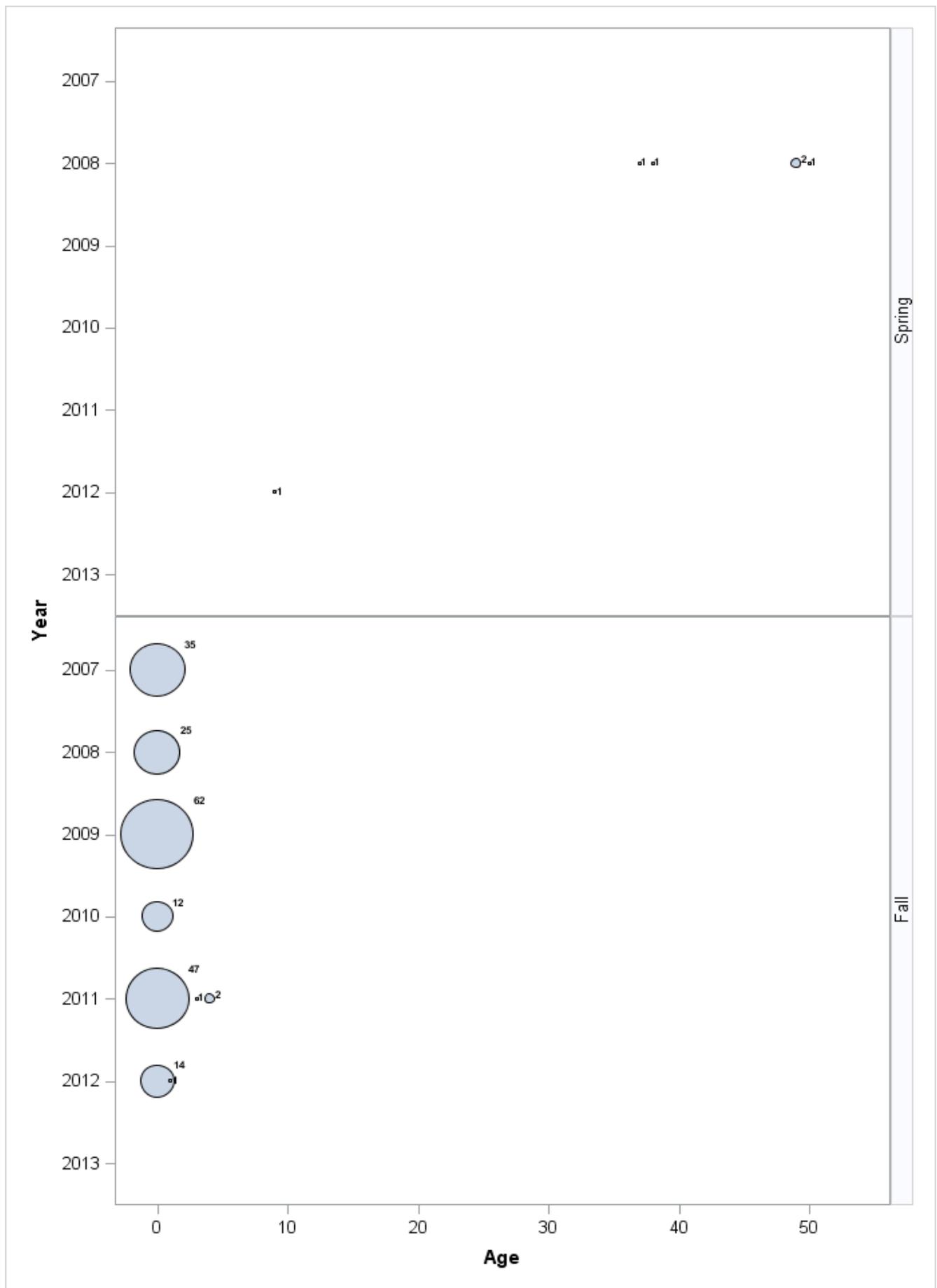
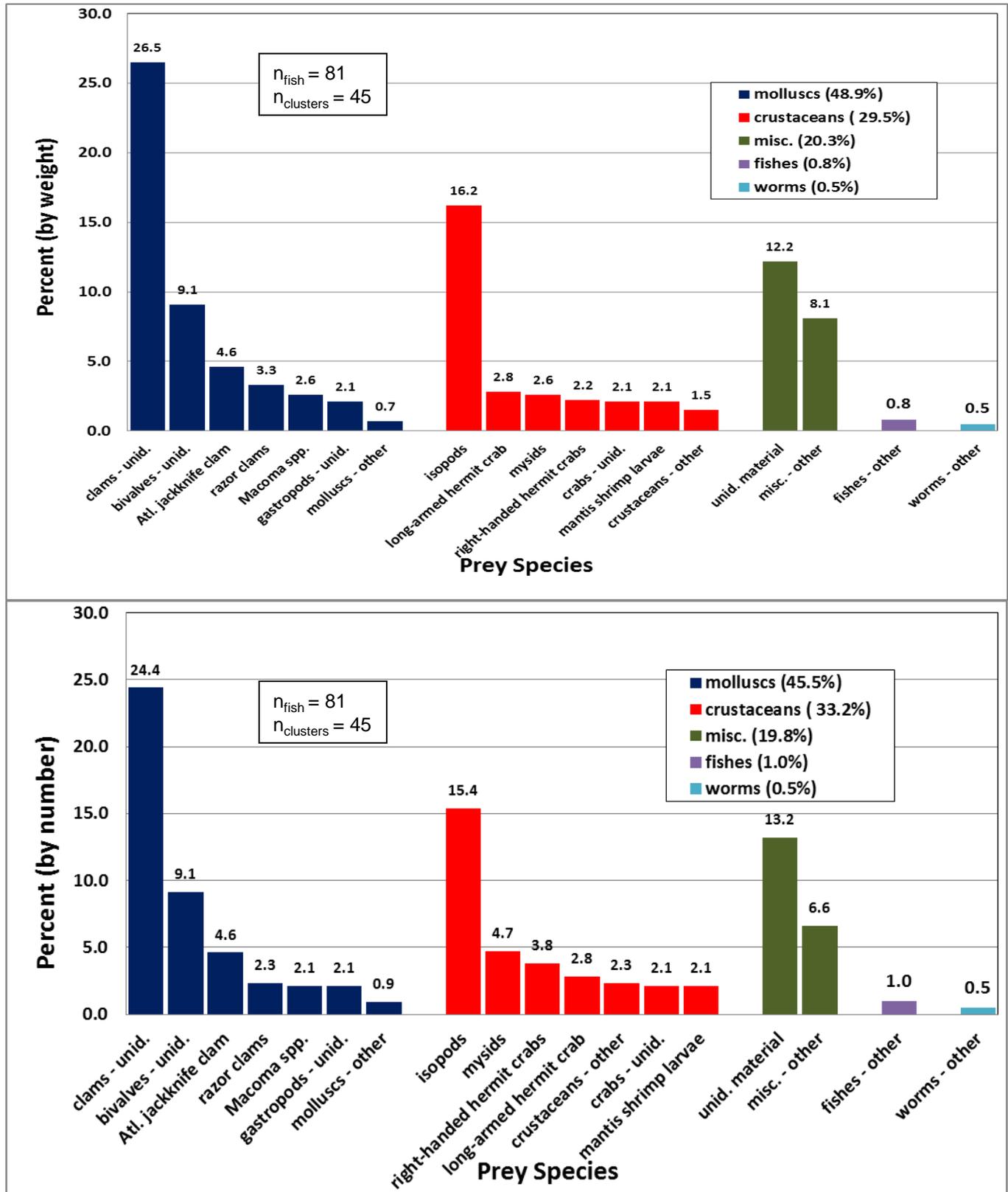
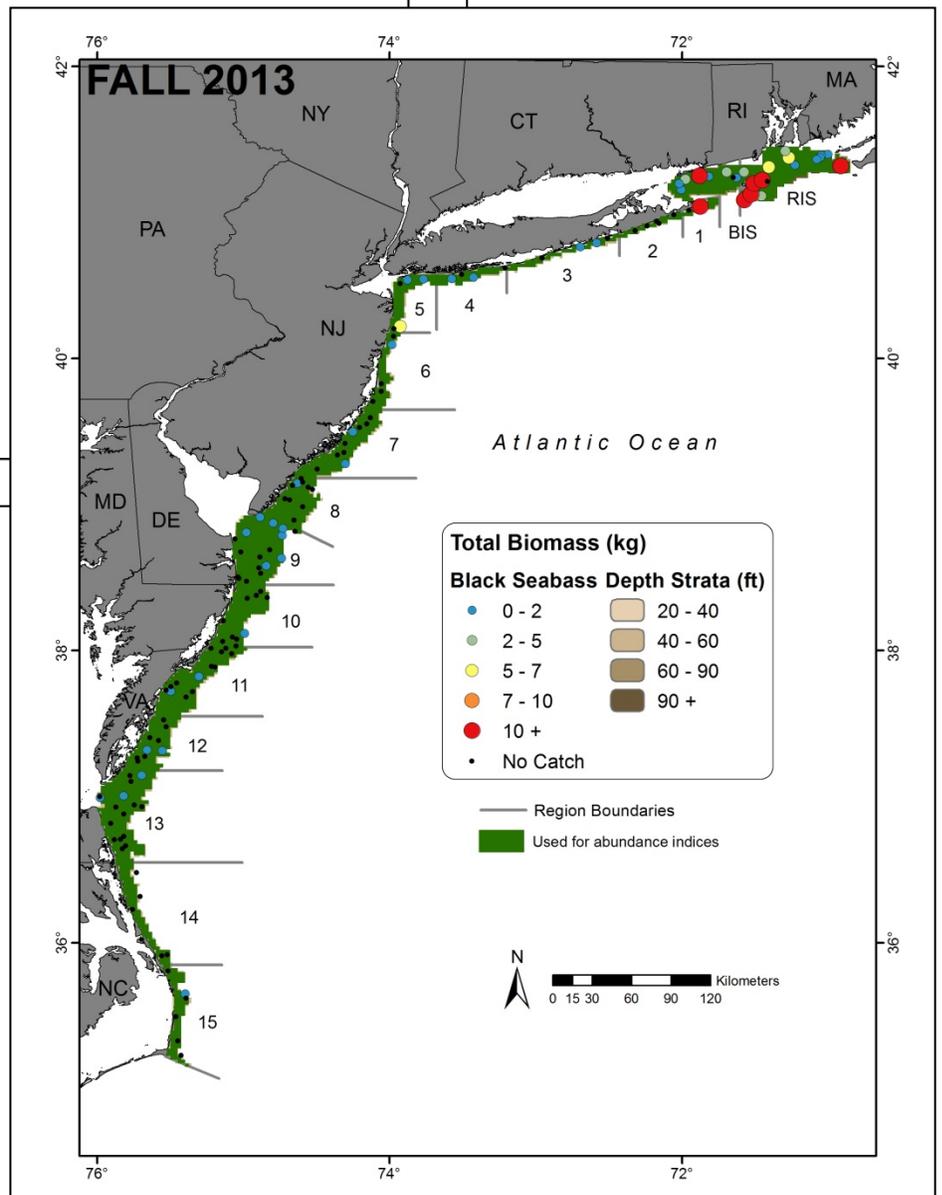
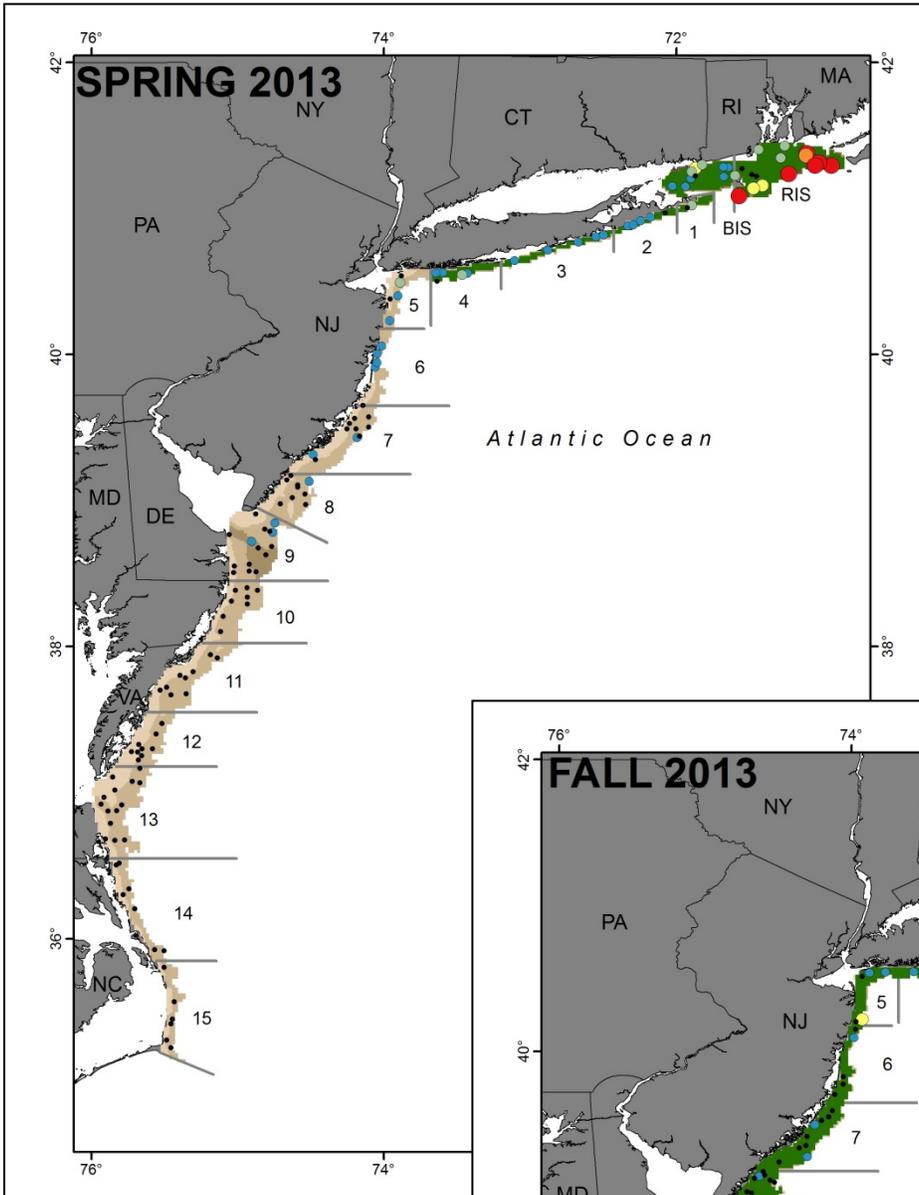
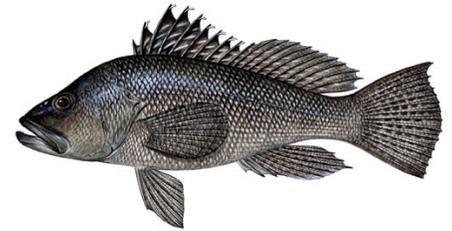


Figure 57. Black Drum diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Black Sea Bass Sampling Priority: A

Figure 58. Black Sea Bass biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[Green]	[Green]
		90+		
	BIS	60-90	[Green]	[Green]
		90+		
NY	01	40-60	[Green]	[Green]
		20-40		
	02	40-60	[Green]	[Green]
		20-40		
	03	20-40	[Green]	[Green]
04	40-60	[Green]	[Green]	
	20-40	[Green]	[Green]	
	40-60	[Green]	[Green]	
05	20-40	[Green]	[Green]	
	40-60	[Green]	[Green]	
NJ	06	20-40	[Green]	[Green]
		40-60	[Green]	[Green]
	07	20-40	[Green]	[Green]
		40-60	[Green]	[Green]
08	20-40	[Green]	[Green]	
	40-60	[Green]	[Green]	
DE	09	20-40	[Green]	[Green]
		40-60	[Green]	[Green]
	60-90	[Green]	[Green]	
MD	10	20-40	[Green]	[Green]
		40-60	[Green]	[Green]
VA	11	20-40	[Green]	[Green]
		40-60	[Green]	[Green]
	40-60	[Green]	[Green]	
12	20-40	[Green]	[Green]	
	40-60	[Green]	[Green]	
13	20-40	[Green]	[Green]	
	40-60	[Green]	[Green]	
NC	14	20-40	[Green]	[Green]
		40-60	[Green]	[Green]
	20-40	[Green]	[Green]	
		40-60	[Green]	[Green]

Total Biomass (kg)

Black Seabass Depth Strata (ft)

- 0 - 2
- 2 - 5
- 5 - 7
- 7 - 10
- 10 +
- No Catch
- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

— Region Boundaries

■ Used for abundance indices

N

0 15 30 60 90 120 Kilometers

Table 24. Black Sea Bass sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	166	83.9	166	140	140	119	115
	2009	237	67.6	237	168	168	163	161
	2010	114	54.7	114	112	112	97	90
	2011	136	61.8	136	121	121	86	83
	2012	260	50.9	260	177	177	146	139
	2013	498	146.7	498	229	229	185	182
Fall	2007	401	85.3	401	219	219	211	211
	2008	174	75.2	174	115	115	114	114
	2009	470	94.5	375	148	148	138	136
	2010	121	42.8	121	90	90	86	86
	2011	196	67.3	196	169	169	150	147
	2012	1,481	237.9	588	223	223	195	189
	2013	572	218.3	572	182	182	148	0

Table 25. Black Sea Bass geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys.

Spring Survey										Fall Survey									
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index				
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI		
All	2007								2007	150	0.60	0.85	1.13	0.17	0.28	0.38			
	2008	44	1.13	1.68	2.39	0.77	1.18	1.68	2008	150	0.31	0.45	0.61	0.07	0.15	0.23			
	2009	47	1.17	1.64	2.21	0.55	0.84	1.18	2009	160	0.43	0.66	0.93	0.15	0.26	0.38			
	2010	43	0.83	1.30	1.90	0.49	0.78	1.13	2010	150	0.24	0.36	0.49	0.10	0.16	0.22			
	2011	43	1.40	1.99	2.72	0.64	1.00	1.44	2011	150	0.52	0.69	0.87	0.18	0.25	0.33			
	2012	43	1.67	2.36	3.23	0.60	0.87	1.19	2012	150	0.75	1.05	1.40	0.23	0.37	0.51			
	2013	43	3.52	5.66	8.81	1.57	2.33	3.30	2013	150	0.67	0.89	1.14	0.30	0.43	0.57			
2014								2014											
2015								2015											
2016								2016											
0	2007								2007	150	0.23	0.35	0.48	0.03	0.05	0.08			
	2008								2008	150	0.13	0.21	0.29	0.01	0.02	0.03			
	2009								2009	160	0.16	0.27	0.38	0.01	0.04	0.07			
	2010								2010	150	0.07	0.13	0.20	0.01	0.02	0.03			
	2011								2011	150	0.13	0.20	0.27	0.01	0.01	0.02			
	2012								2012	150	0.16	0.28	0.41	0.00	0.05	0.10			
	2013								2013	150	0.12	0.20	0.28	0.01	0.02	0.03			
2014								2014											
2015								2015											
2016								2016											
1	2007								2007	150	0.27	0.39	0.53	0.05	0.08	0.12			
	2008	44	0.04	0.09	0.14	0.01	0.02	0.03	2008	150	0.09	0.15	0.22	0.01	0.03	0.04			
	2009	47	0.11	0.24	0.38	0.01	0.02	0.03	2009	160	0.17	0.30	0.45	0.03	0.09	0.14			
	2010	43	0.01	0.03	0.06	0.00	0.00	0.01	2010	150	0.06	0.12	0.18	0.01	0.02	0.03			
	2011	43	0.10	0.23	0.37	0.00	0.01	0.02	2011	150	0.15	0.22	0.30	0.02	0.04	0.05			
	2012	43	0.27	0.46	0.69	0.02	0.03	0.04	2012	150	0.33	0.51	0.72	0.03	0.10	0.18			
	2013	43	0.29	0.56	0.90	0.03	0.08	0.13	2013	150	0.13	0.22	0.33	0.02	0.06	0.11			
2014								2014											
2015								2015											
2016								2016											
2	2007								2007	150	0.16	0.26	0.37	0.05	0.10	0.15			
	2008	44	0.29	0.48	0.70	0.11	0.19	0.28	2008	150	0.04	0.08	0.13	0.00	0.03	0.07			
	2009	47	0.30	0.46	0.63	0.07	0.10	0.14	2009	160	0.10	0.20	0.32	0.03	0.08	0.13			
	2010	43	0.27	0.44	0.64	0.09	0.14	0.20	2010	150	0.05	0.08	0.12	0.01	0.03	0.04			
	2011	43	0.27	0.45	0.65	0.09	0.16	0.24	2011	150	0.10	0.16	0.23	0.02	0.04	0.07			
	2012	43	0.49	0.72	0.98	0.14	0.20	0.27	2012	150	0.22	0.36	0.51	0.03	0.09	0.16			
	2013	43	1.49	2.71	4.52	0.37	0.65	1.00	2013	150	0.19	0.33	0.48	0.06	0.14	0.23			
2014								2014											
2015								2015											
2016								2016											
3	2007								2007	150	0.09	0.17	0.25	0.04	0.08	0.13			
	2008	44	0.40	0.67	1.00	0.20	0.34	0.51	2008	150	0.01	0.06	0.11	0.00	0.04	0.09			
	2009	47	0.38	0.55	0.74	0.16	0.25	0.35	2009	160	0.07	0.15	0.23	0.03	0.07	0.11			
	2010	43	0.34	0.55	0.78	0.16	0.25	0.36	2010	150	0.03	0.05	0.08	0.01	0.03	0.04			
	2011	43	0.33	0.54	0.78	0.17	0.29	0.42	2011	150	0.03	0.08	0.13	0.02	0.05	0.08			
	2012	43	0.42	0.62	0.85	0.20	0.30	0.41	2012	150	0.04	0.09	0.14	0.03	0.05	0.08			
	2013	43	0.71	1.08	1.53	0.29	0.43	0.58	2013	150	0.10	0.18	0.26	0.07	0.11	0.16			
2014								2014											
2015								2015											
2016								2016											
4+	2007								2007	150	0.03	0.06	0.10	0.02	0.06	0.10			
	2008	44	0.42	0.70	1.03	0.39	0.71	1.10	2008	150	0.01	0.06	0.12	0.01	0.07	0.14			
	2009	47	0.29	0.49	0.72	0.28	0.52	0.80	2009	160	0.03	0.07	0.10	0.03	0.08	0.13			
	2010	43	0.35	0.58	0.84	0.28	0.50	0.75	2010	150	0.04	0.07	0.11	0.04	0.08	0.12			
	2011	43	0.49	0.78	1.14	0.38	0.65	0.98	2011	150	0.10	0.16	0.22	0.10	0.16	0.21			
	2012	43	0.46	0.69	0.96	0.29	0.45	0.62	2012	150	0.12	0.20	0.28	0.10	0.18	0.26			
	2013	43	1.02	1.54	2.20	0.84	1.32	1.93	2013	150	0.20	0.30	0.41	0.16	0.25	0.35			
2014								2014											
2015								2015											
2016								2016											

Figure 59. Black Sea Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

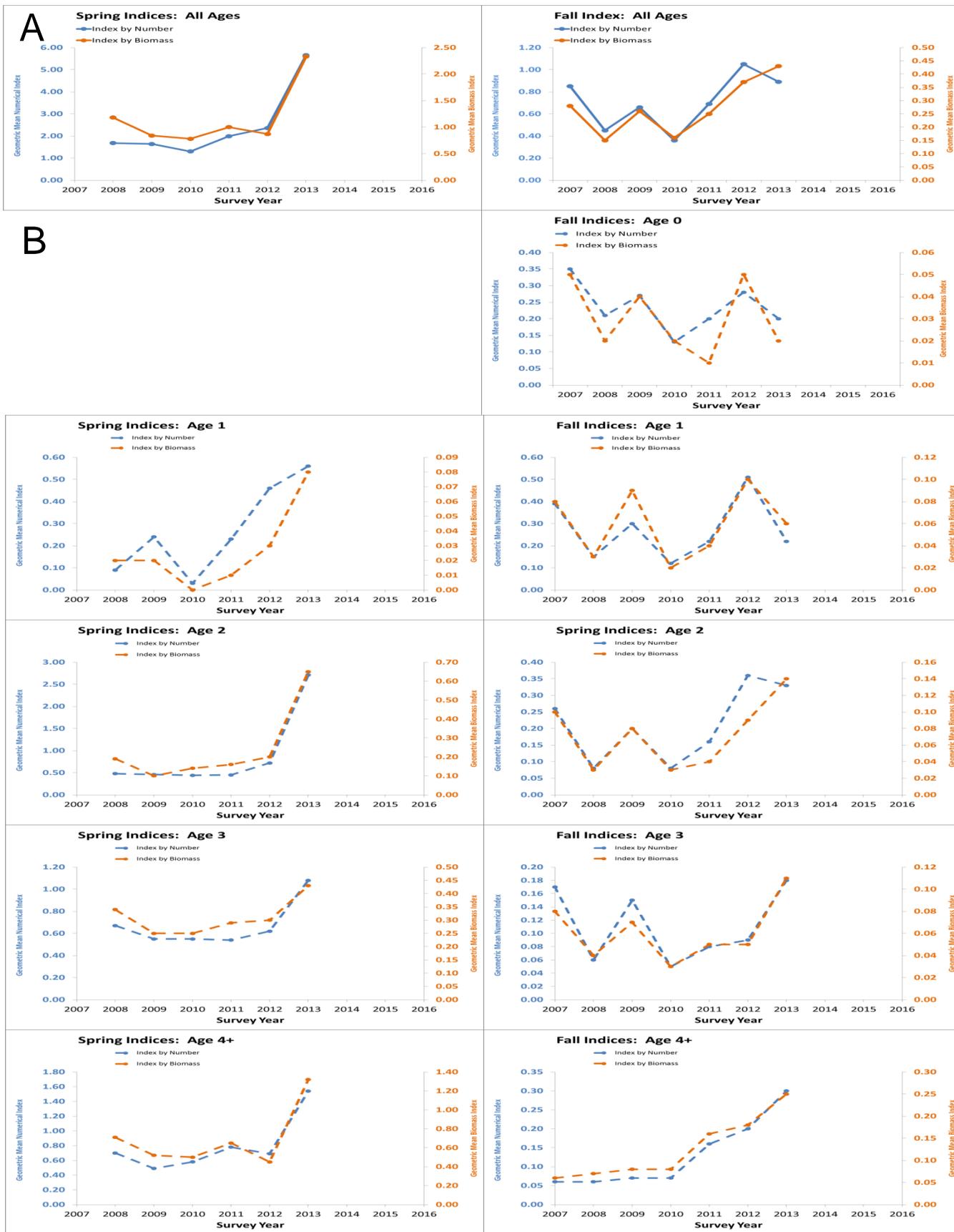


Figure 60. Black Sea Bass length-frequency distributions, by cruise.

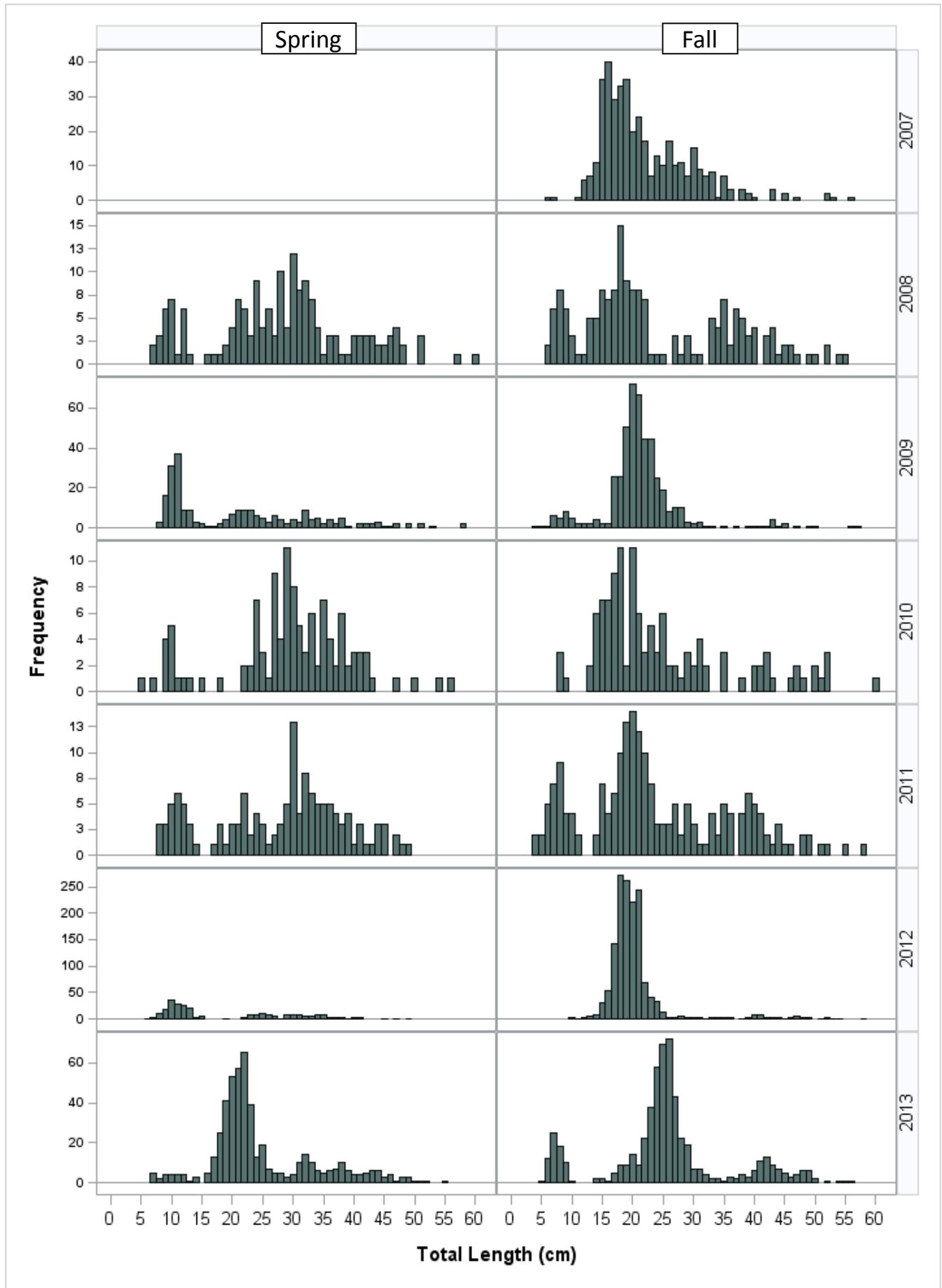


Figure 61. Black Sea Bass length-frequency distributions, by cruise and sex.

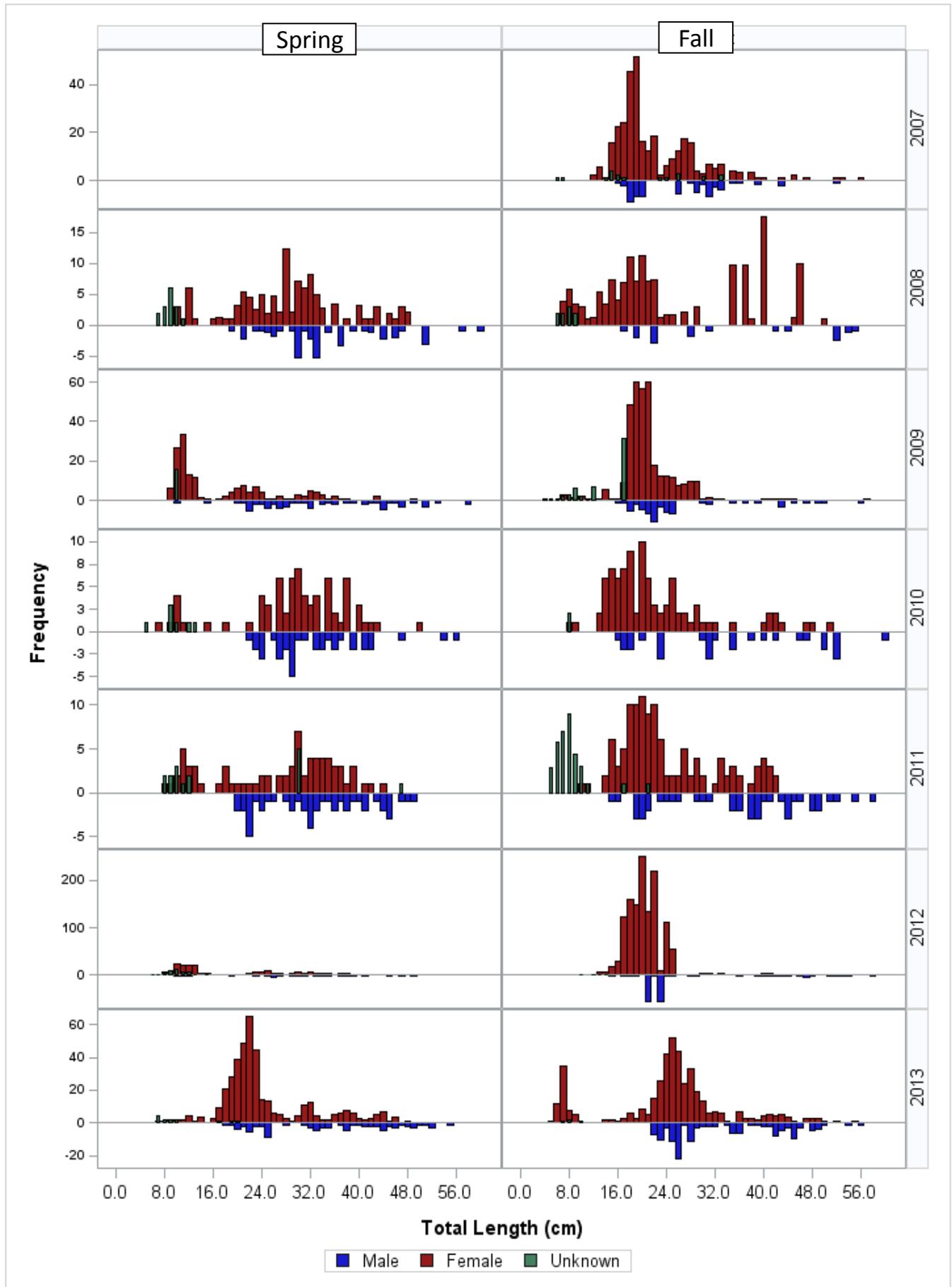


Figure 62. Black Sea Bass age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

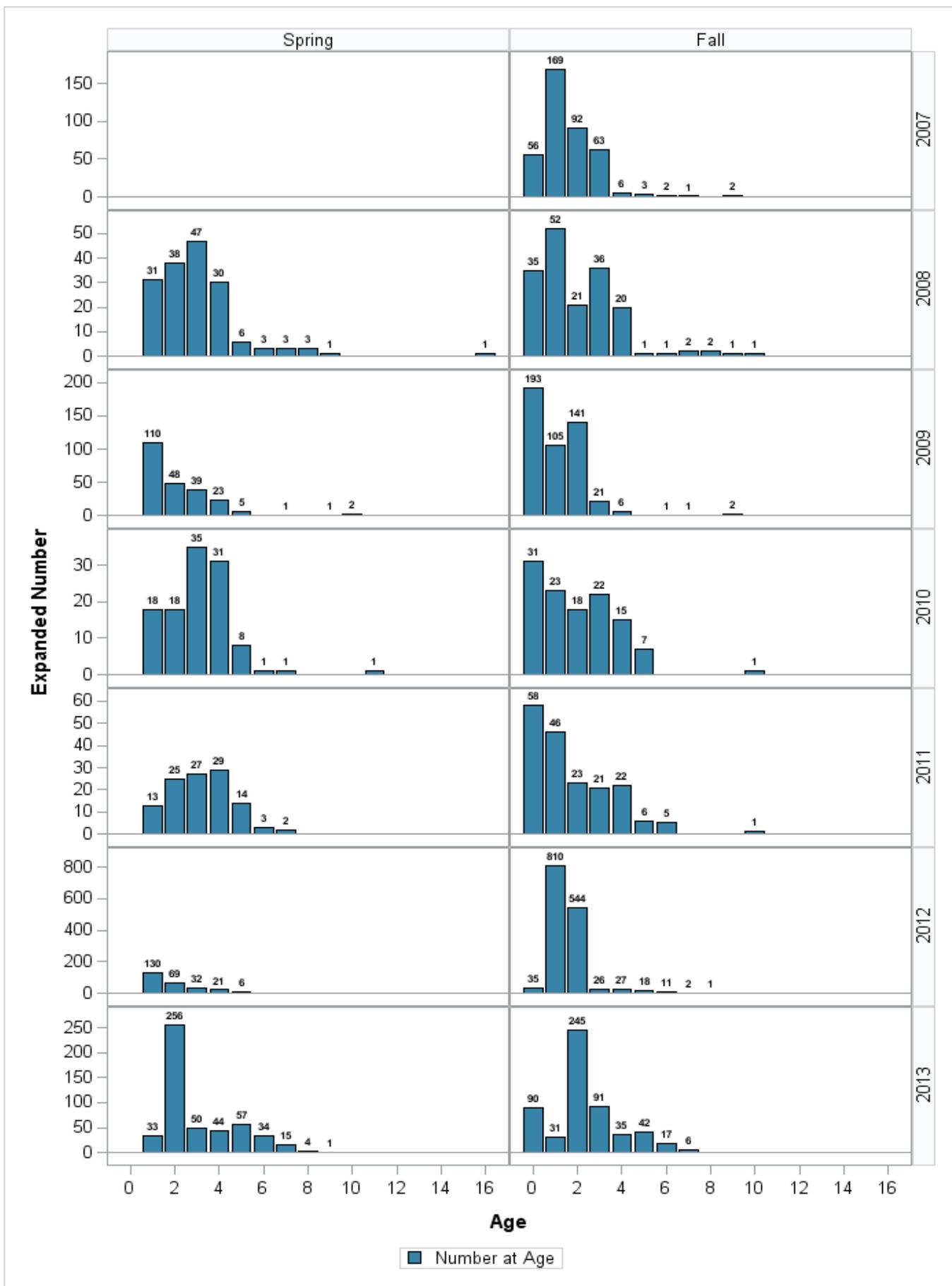


Figure 63. Black Sea Bass catch-at-age standardized to 3,000 trawl minutes, by cruise.

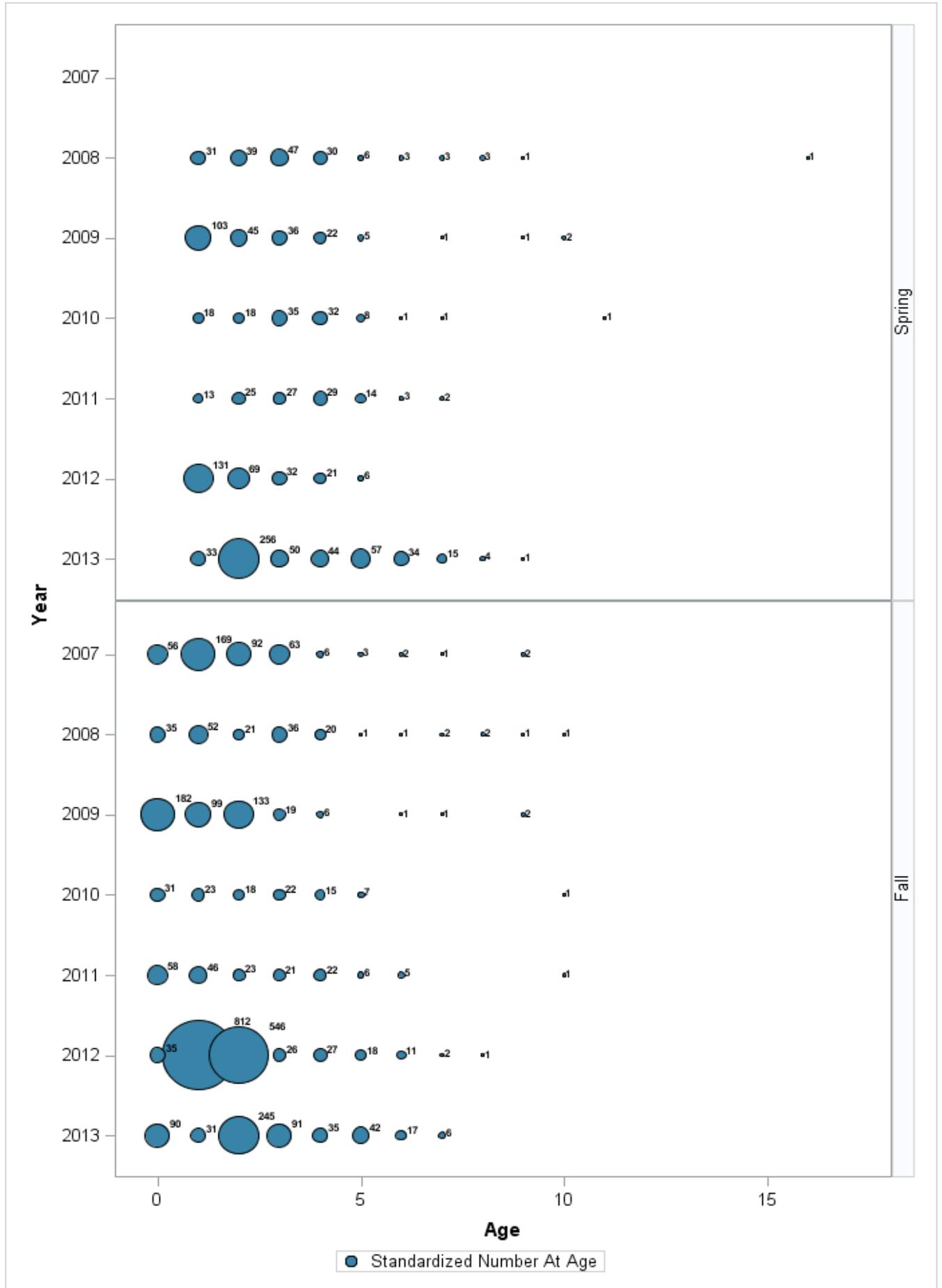


Figure 65. Black Sea Bass sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

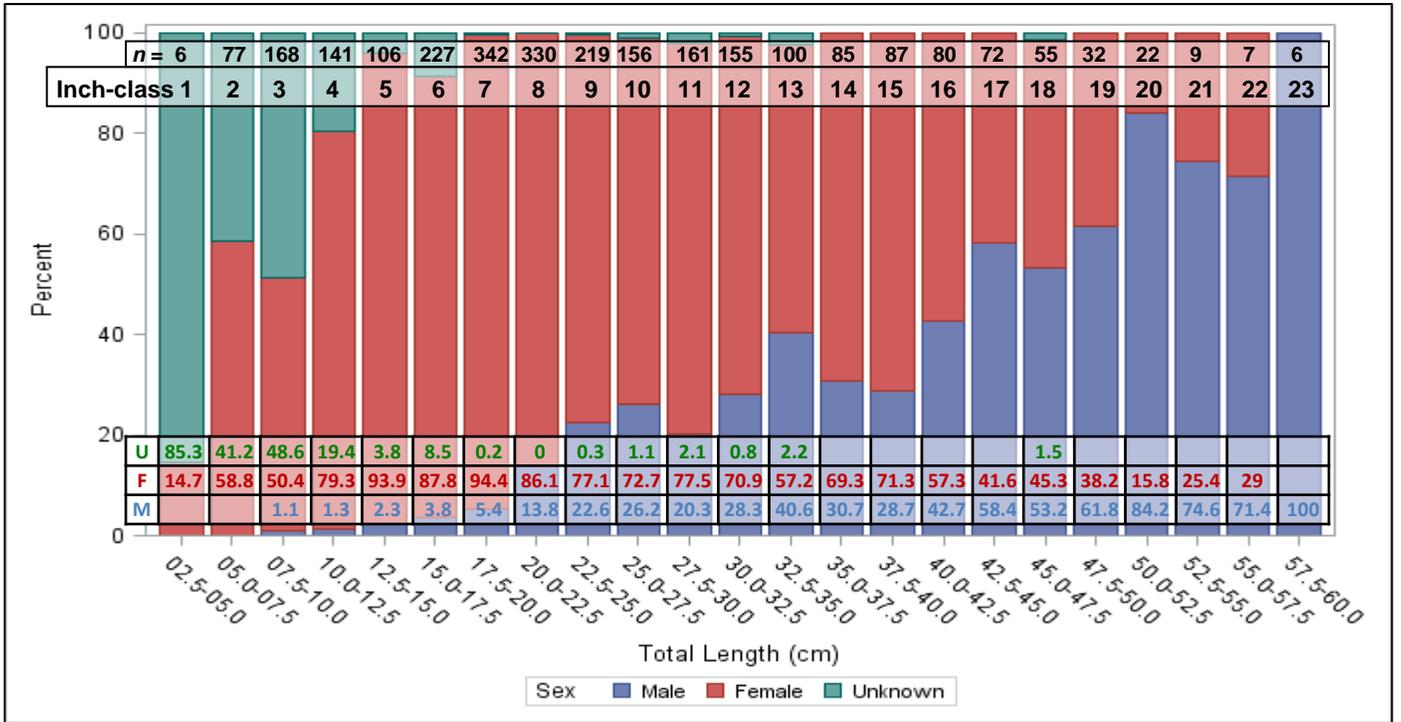


Figure 66. Black Sea Bass maturity at length, by sex for all cruises pooled, 2007-2013.

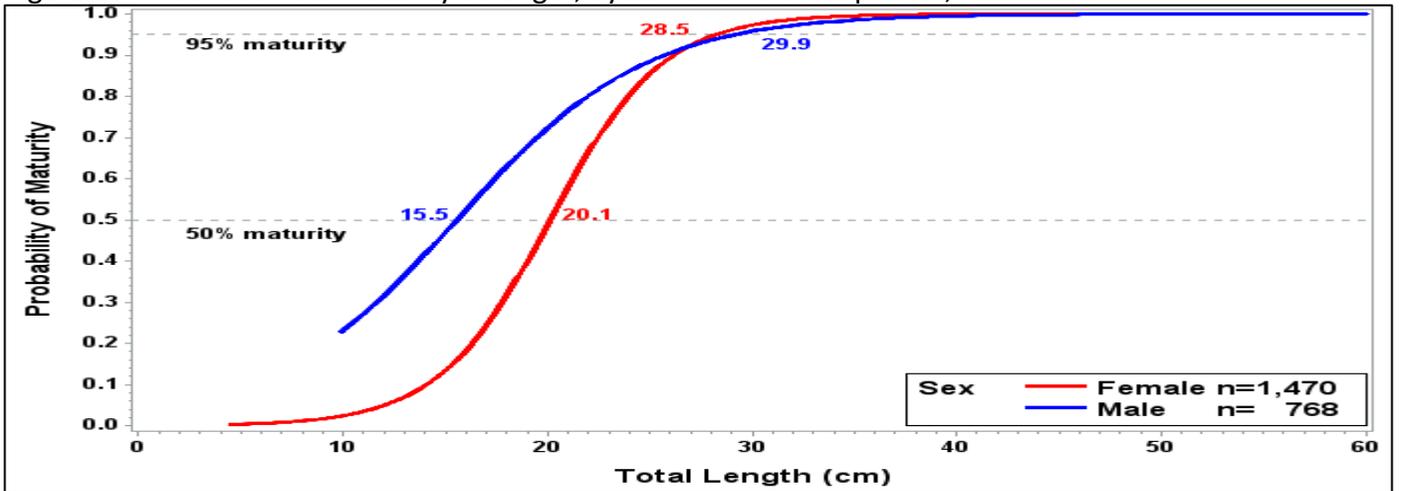


Figure 67. Black Sea Bass maturity at age, by sex for all cruises pooled, 2007-2013.

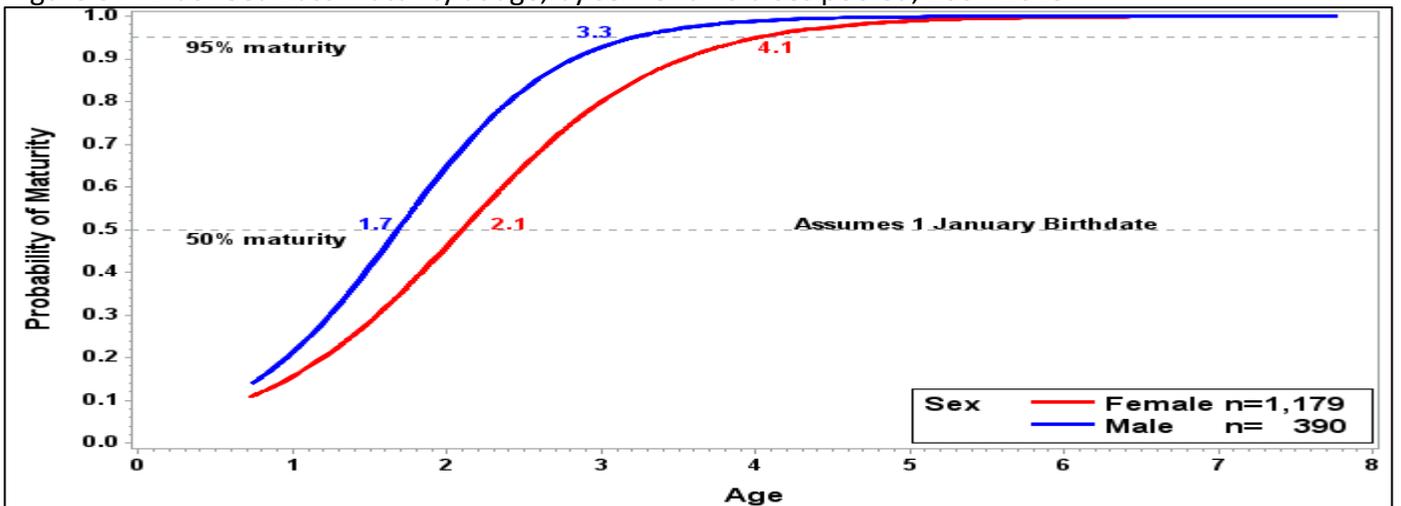
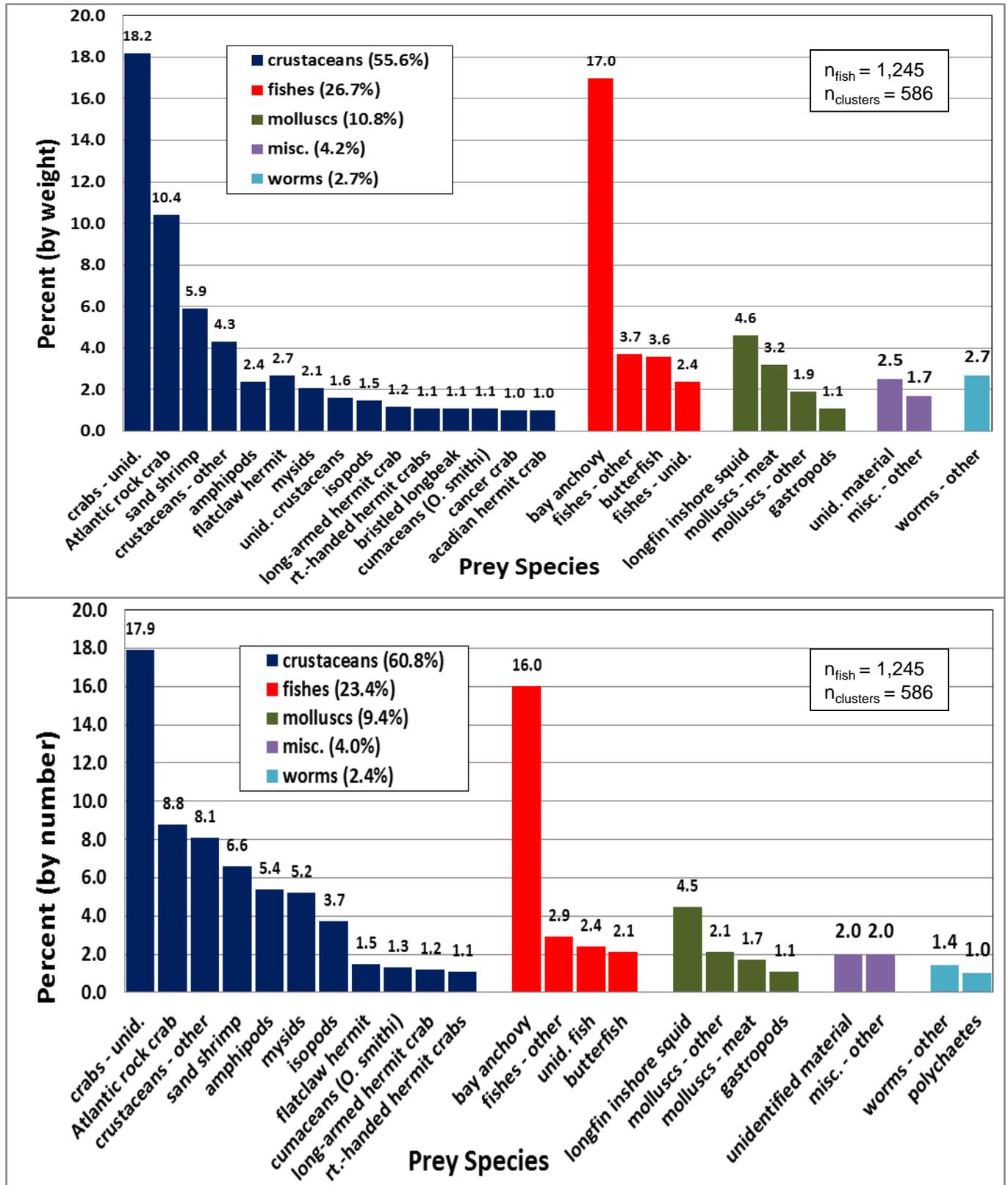
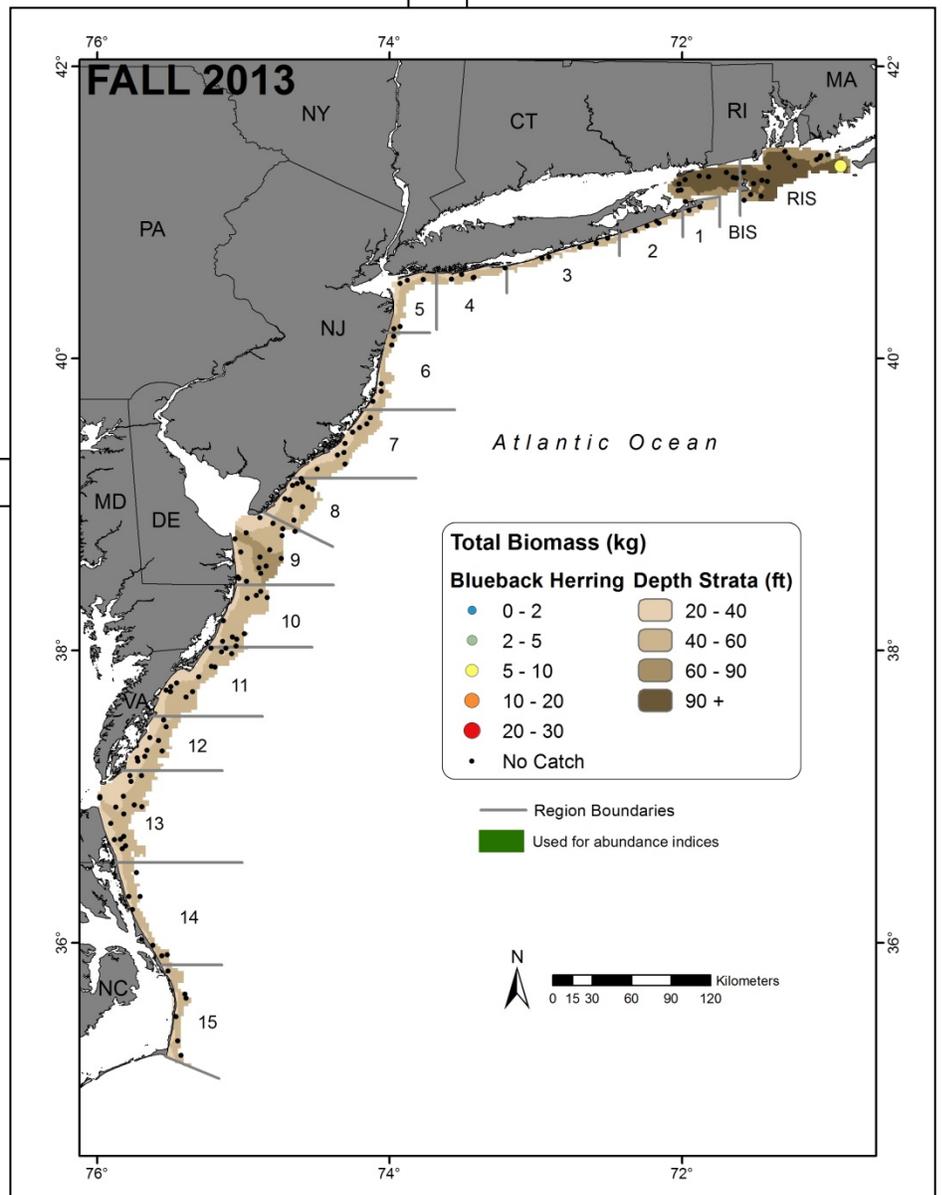
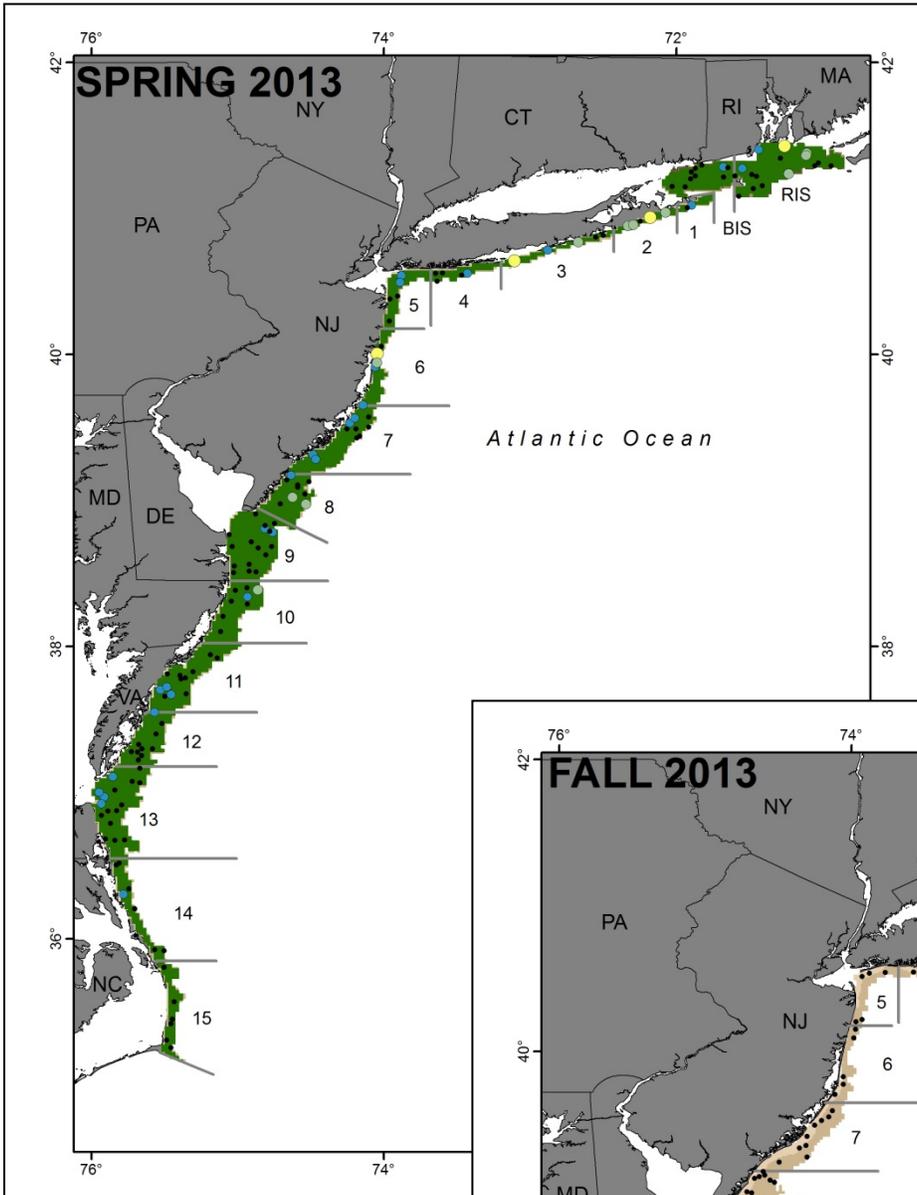


Figure 68. Black Sea Bass diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Blueback Herring Sampling Priority: A

Figure 69. Blueback Herring biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	■
		90+		
	BIS	60-90		
90+				
NY	O1	40-60	■	■
		20-40		
	O2	40-60		
		20-40		
	O3	40-60		
20-40				
NJ	O4	40-60	■	■
		20-40		
	O5	40-60		
20-40				
DE	O6	20-40	■	■
		40-60		
	O7	20-40		
O8		40-60		
	O9	20-40	■	■
40-60				
60-90				
MD	10	20-40	■	■
		40-60		
VA	11	20-40	■	■
		40-60		
	12	20-40		
13		20-40	■	■
	40-60			
NC	14	20-40	■	■
		40-60		
	15	20-40		
40-60				

■ = used for abundance indices
■ = not used for abundance indices

Total Biomass (kg)

Blueback Herring Depth Strata (ft)

- 0 - 2
- 2 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- No Catch
- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

— Region Boundaries
■ Used for abundance indices

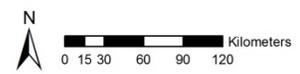


Table 26. Blueback Herring sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	3,693	62.2	1,774	237	0	235	0
	2009	5,603	160.3	2,808	315	0	315	2
	2010	4,992	86.6	2,436	280	0	276	21
	2011	77,071	957.3	2,713	226	0	220	217
	2012	6,258	70.0	2,221	144	0	141	131
	2013	4,484	72.0	3,430	178	0	169	162
Fall	2007	50	1.6	50	18	0	18	0
	2008	20	0.7	20	9	0	9	0
	2009	15	0.6	15	6	0	6	6
	2010	22	0.6	22	15	0	14	12
	2011	2	0.1	2	2	0	2	2
	2012	4	0.1	4	4	0	4	3
	2013	152	8.3	152	5	0	4	0

Table 27. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured and for the youngest year class captured.

Spring Survey								
Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007							
	2008	150	1.06	1.61	2.31	0.11	0.19	0.26
	2009	160	1.45	2.18	3.12	0.21	0.33	0.45
	2010	150	1.28	1.98	2.88	0.11	0.20	0.30
	2011	150	0.75	1.18	1.73	0.10	0.17	0.25
	2012	150	0.61	1.12	1.79	0.08	0.17	0.26
	2013	150	0.68	1.09	1.61	0.10	0.17	0.24
	2014							
0	2007							
	2008							
	2009							
	2010							
	2011							
	2012							
	2013							
1	2007							
	2008	150	0.81	1.27	1.84	0.07	0.13	0.19
	2009	160	0.72	1.14	1.68	0.07	0.14	0.20
	2010	150	1.05	1.66	2.44	0.09	0.17	0.25
	2011	150	0.54	0.92	1.39	0.06	0.13	0.20
	2012	150	0.55	1.04	1.68	0.07	0.16	0.25
	2013	150	0.55	0.90	1.33	0.08	0.14	0.20
	2014							
2015								
2016								

Figure 70. Blueback Herring geometric mean indices of abundance, by number and biomass, for spring NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

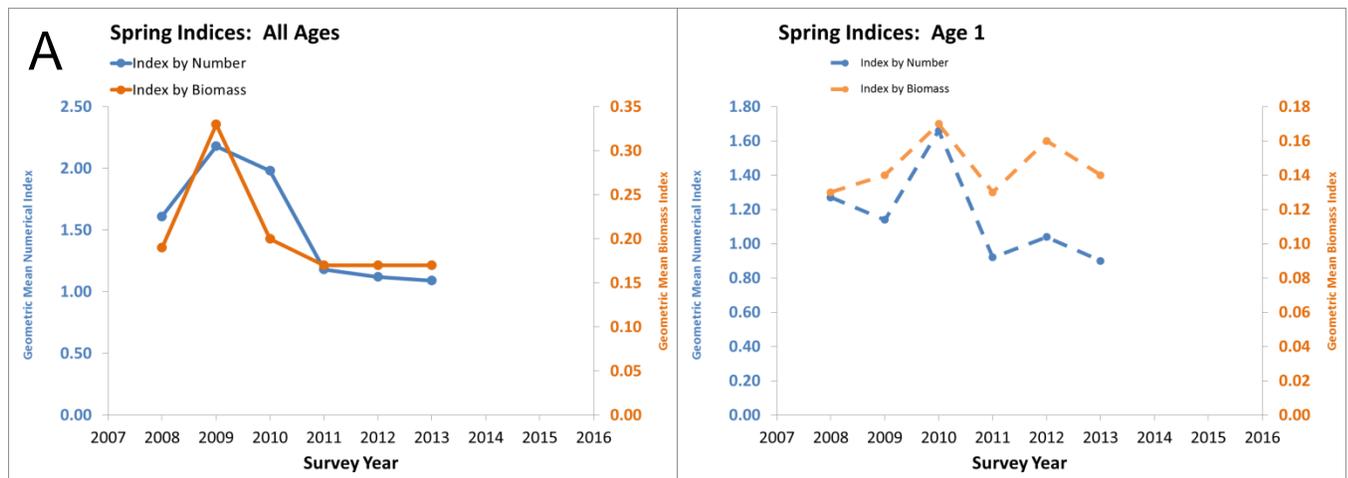


Figure 71. Blueback Herring length-frequency distributions, by cruise (Blue reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values - spring 14cm - estimated by examination of these length frequency figures.)

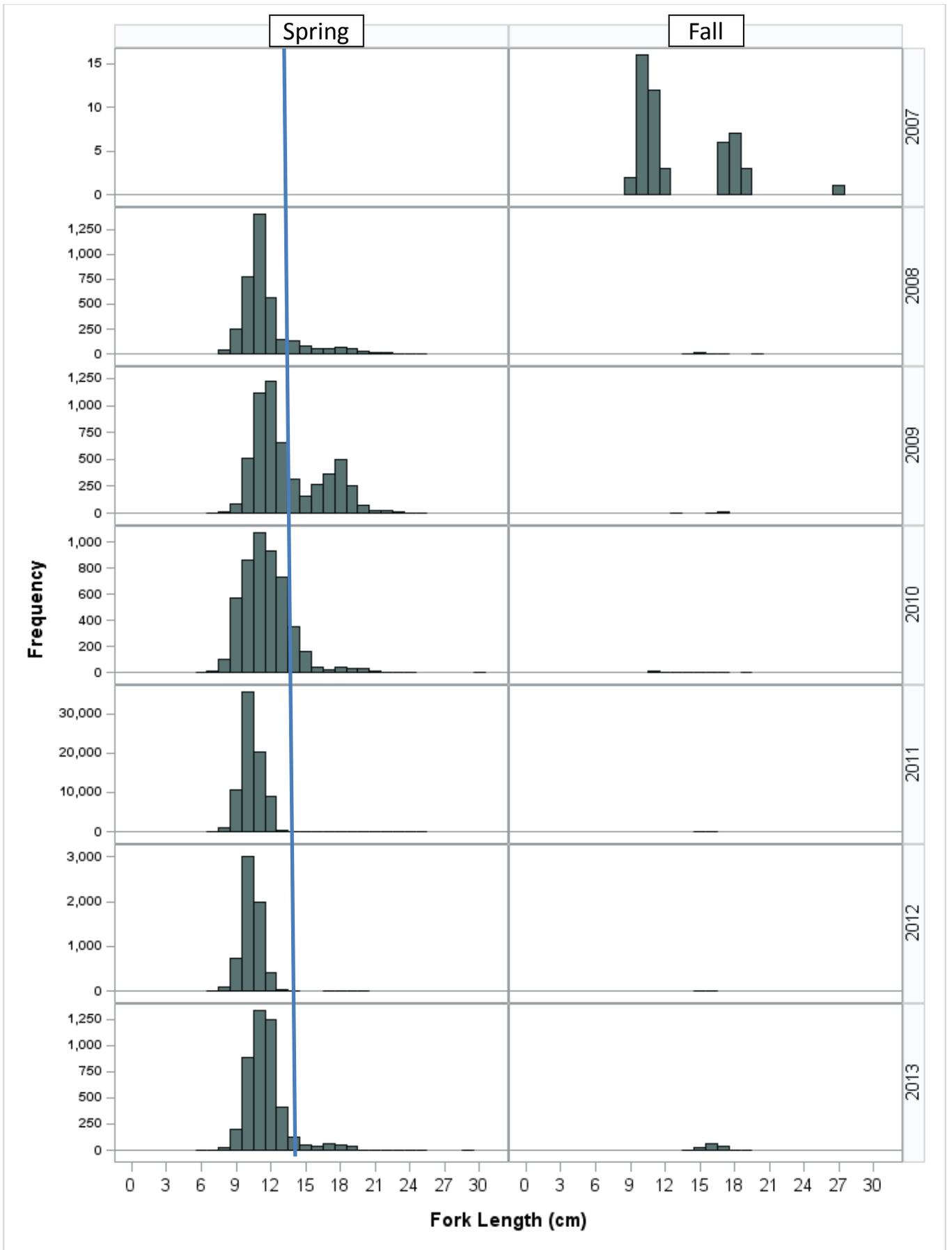


Figure 72. Blueback Herring sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

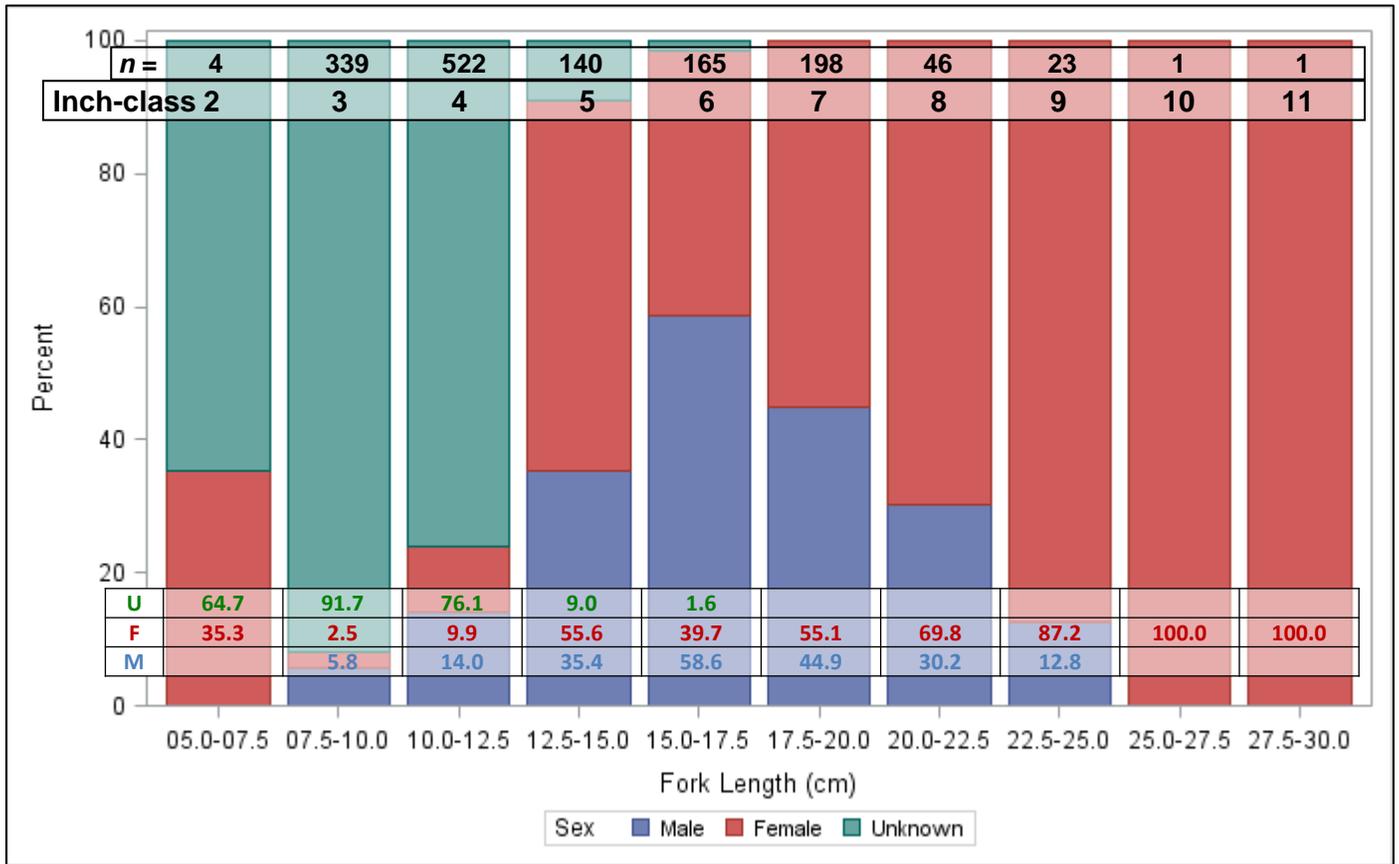


Figure 73. Blueback Herring maturity at length, by sex for all cruises pooled, 2007-2013.

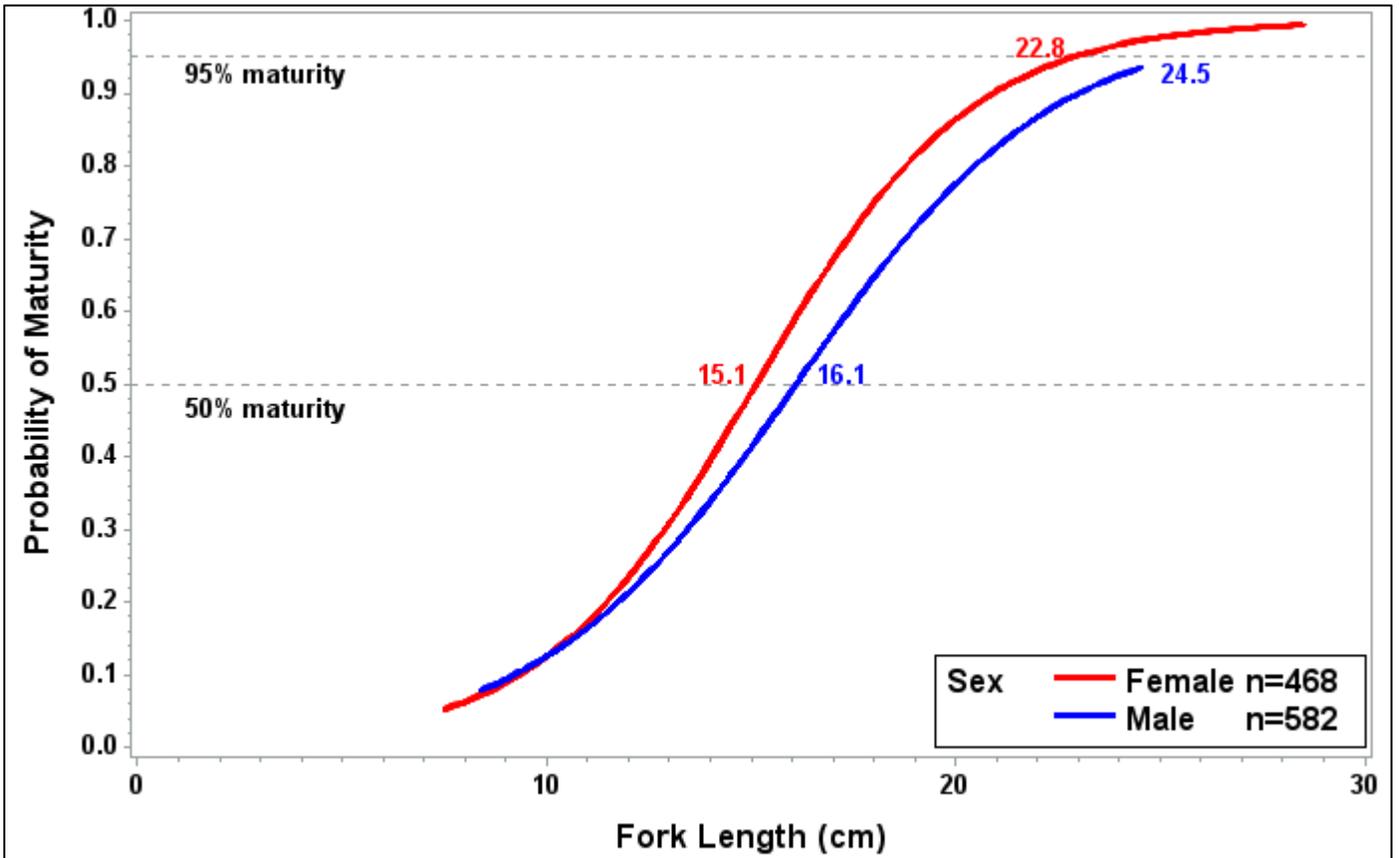
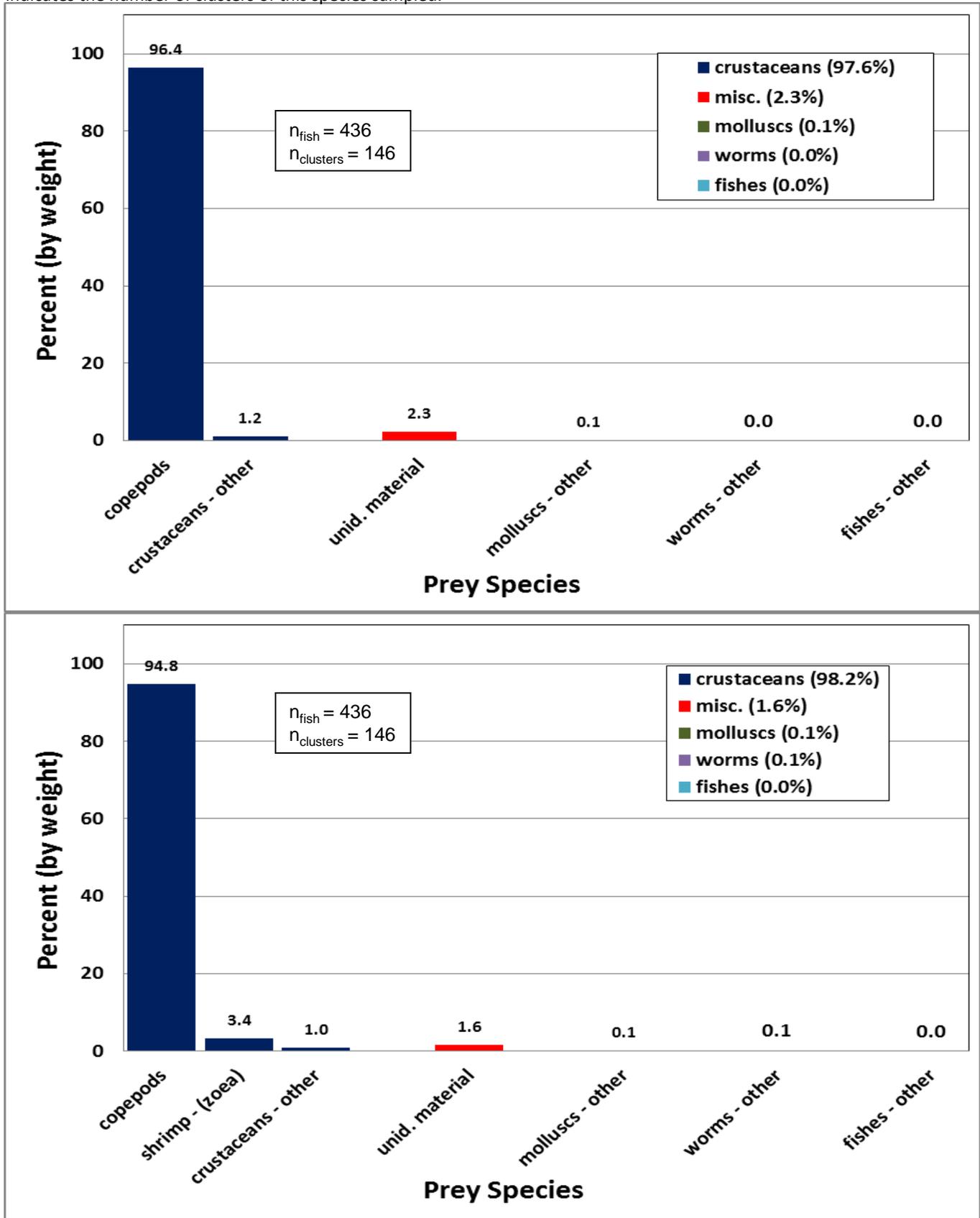


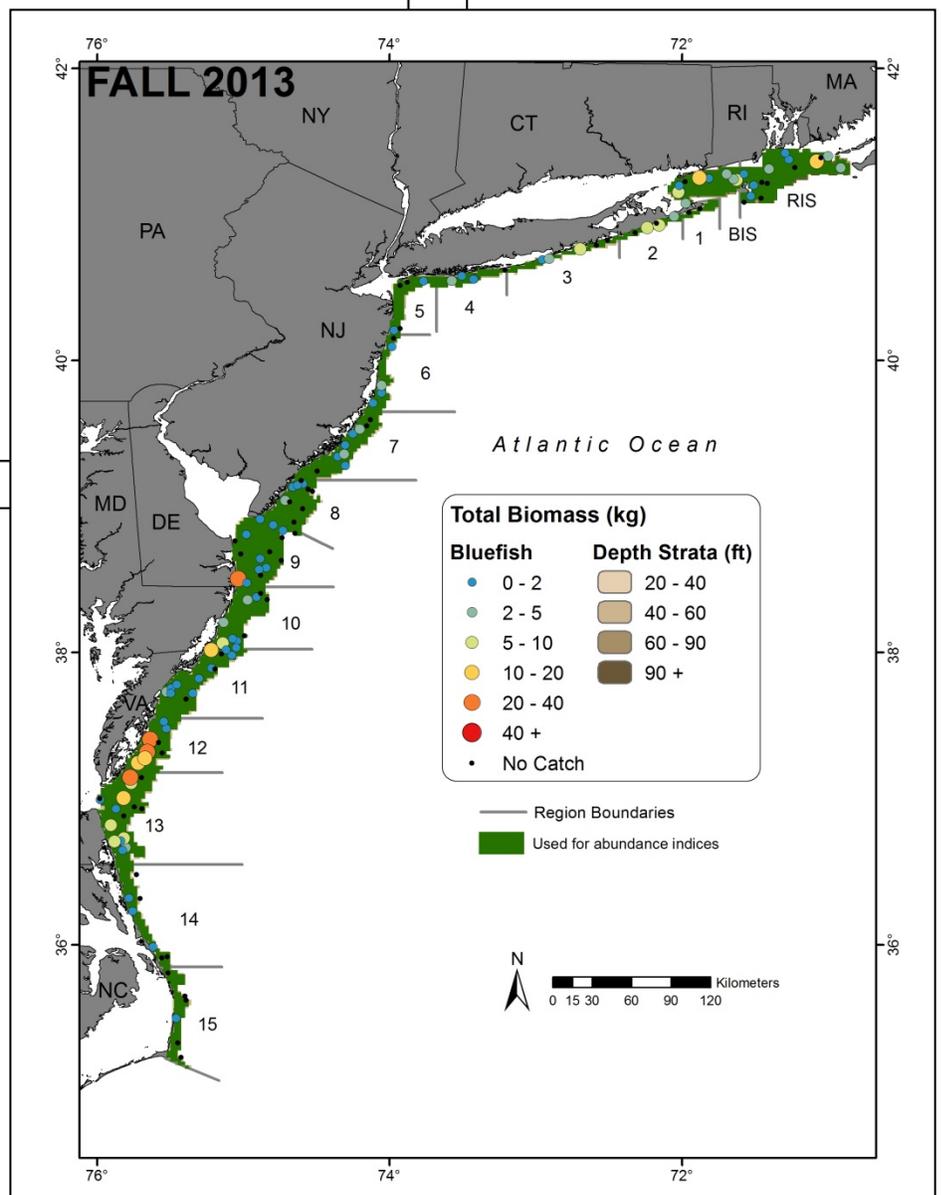
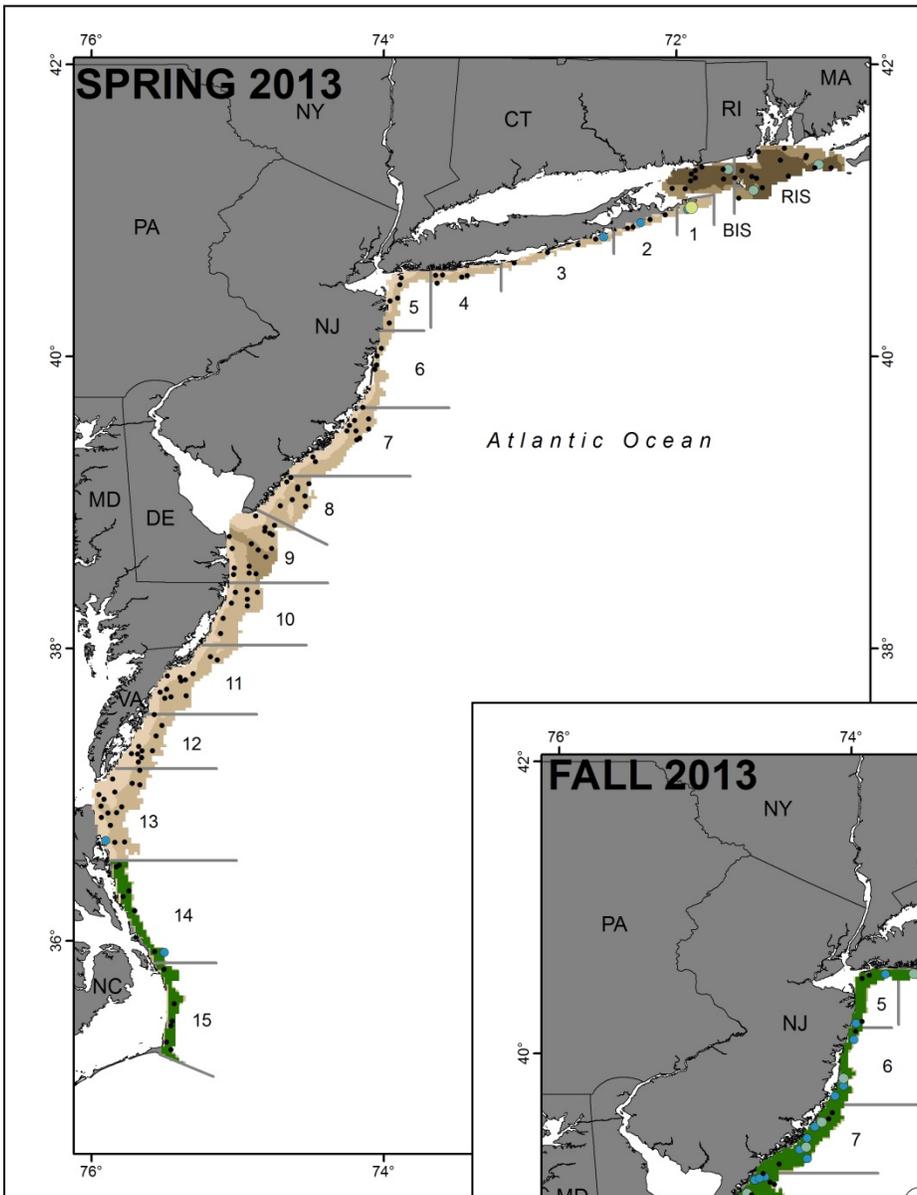
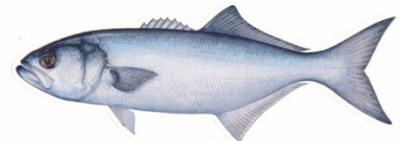
Figure 74. Blueback herring diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled).



Bluefish

Sampling Priority: A

Figure 75. Bluefish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
NY	01	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
NJ	06	20-40		
		40-60		
		20-40		
		40-60		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 28. Bluefish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	37	10.9	37	27	26	24	24
	2009	1,580	91.2	274	35	33	14	13
	2010	312	21.4	68	18	18	15	15
	2011	18	10.5	18	11	11	3	3
	2012	74	18.7	74	40	40	15	15
	2013	12	22.6	12	12	12	6	4
Fall	2007	4,635	394.5	2,613	588	588	485	478
	2008	7,120	908.7	2,214	529	525	410	402
	2009	18,075	910.7	4,016	632	617	432	421
	2010	4,432	271.6	1,967	498	471	379	369
	2011	3,885	454.9	1,887	482	472	295	283
	2012	6,308	738.7	3,390	579	579	447	424
	2013	3,173	329.7	2,428	392	392	250	0

Table 29. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age (Age-0 spring and summer cohorts shown separately).

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	150	3.14	4.29	5.76	0.99	1.28	1.60
	2008	13	0.00	0.66	1.94	0.00	0.07	0.15		2008	150	3.81	5.23	7.08	0.94	1.28	1.68
	2009	15	0.56	1.40	2.70	0.34	0.42	0.50		2009	160	3.90	5.23	6.93	0.69	0.91	1.16
	2010	13	0.00	1.38	6.72	0.00	0.37	1.38		2010	150	2.42	3.28	4.35	0.63	0.82	1.03
	2011	13	0.00	0.34	1.15	0.00	0.12	0.37		2011	150	3.01	4.02	5.28	0.87	1.16	1.50
	2012	13	0.29	1.31	3.14	0.02	0.34	0.77		2012	150	4.36	5.73	7.45	1.20	1.53	1.91
	2013	13	0.00	0.06	0.19	0.00	0.01	0.04		2013	150	2.69	3.71	5.02	0.66	0.88	1.14
	2014									2014							
	2015									2015							
	2016									2016							
0	2007								0	2007	150	2.37	3.33	4.55	0.55	0.75	0.97
	2008									2008	150	3.15	4.36	5.91	0.54	0.76	1.00
	2009									2009	160	3.52	4.76	6.35	0.50	0.67	0.86
	2010									2010	150	1.96	2.71	3.65	0.32	0.45	0.59
	2011									2011	150	2.45	3.27	4.28	0.56	0.76	1.00
	2012									2012	150	3.75	4.98	6.52	0.89	1.15	1.46
	2013									2013	150	2.53	3.50	4.75	0.53	0.72	0.92
	2014									2014							
	2015									2015							
	2016									2016							
1	2007								1	2007	150	0.34	0.45	0.58	0.16	0.22	0.28
	2008	13	0.00	0.66	1.94	0.00	0.07	0.15		2008	150	0.23	0.38	0.55	0.08	0.17	0.28
	2009	15	0.56	1.40	2.69	0.34	0.41	0.48		2009	160	0.15	0.24	0.33	0.05	0.09	0.13
	2010	13	0.00	1.35	6.45	0.00	0.31	1.11		2010	150	0.19	0.26	0.34	0.07	0.10	0.13
	2011	13	0.00	0.00	0.00	0.00	0.00	0.00		2011	150	0.53	0.73	0.95	0.18	0.26	0.35
	2012	13	0.00	0.45	1.25	0.00	0.08	0.20		2012	150	0.53	0.69	0.86	0.18	0.24	0.30
	2013	13	0.00	0.00	0.00	0.00	0.00	0.00		2013	150	0.05	0.09	0.14	0.01	0.03	0.04
	2014									2014							
	2015									2015							
	2016									2016							
2+	2007								2+	2007	150	0.18	0.25	0.31	0.17	0.25	0.33
	2008									2008	150	0.12	0.20	0.29	0.16	0.27	0.39
	2009									2009	160	0.07	0.11	0.16	0.07	0.14	0.21
	2010									2010	150	0.14	0.20	0.26	0.16	0.24	0.32
	2011									2011	150	0.15	0.22	0.29	0.11	0.17	0.24
	2012									2012	150	0.07	0.12	0.17	0.07	0.13	0.19
	2013									2013	150	0.03	0.08	0.12	0.05	0.12	0.19
	2014									2014							
	2015									2015							
	2016									2016							

Age 0 Cohorts								
Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
Spring Cohort								
0	2007	150	1.08	1.46	1.91	0.30	0.41	0.52
	2008	150	0.84	1.20	1.64	0.15	0.27	0.41
	2009	160	0.46	0.71	0.99	0.11	0.19	0.27
	2010	150	0.51	0.73	0.99	0.13	0.20	0.27
	2011	150	1.50	1.99	2.57	0.37	0.51	0.66
	2012	150	2.58	3.34	4.26	0.63	0.80	1.00
	2013	150	0.74	1.04	1.39	0.16	0.24	0.33
	2014							
	2015							
	2016							

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
Summer Cohort								
0	2007	150	0.84	1.25	1.75	0.16	0.26	0.37
	2008	150	1.84	2.58	3.51	0.31	0.44	0.59
	2009	160	2.13	2.83	3.69	0.28	0.37	0.47
	2010	150	1.18	1.67	2.27	0.16	0.24	0.33
	2011	150	0.50	0.74	1.02	0.10	0.18	0.27
	2012	150	0.39	0.60	0.84	0.09	0.16	0.24
	2013	150	1.16	1.63	2.20	0.23	0.32	0.42
	2014							
	2015							
	2016							

Figure 76. Bluefish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A), for the youngest year class captured (B) and (using fall data only) for the spring and summer age-0 cohorts separately (C).

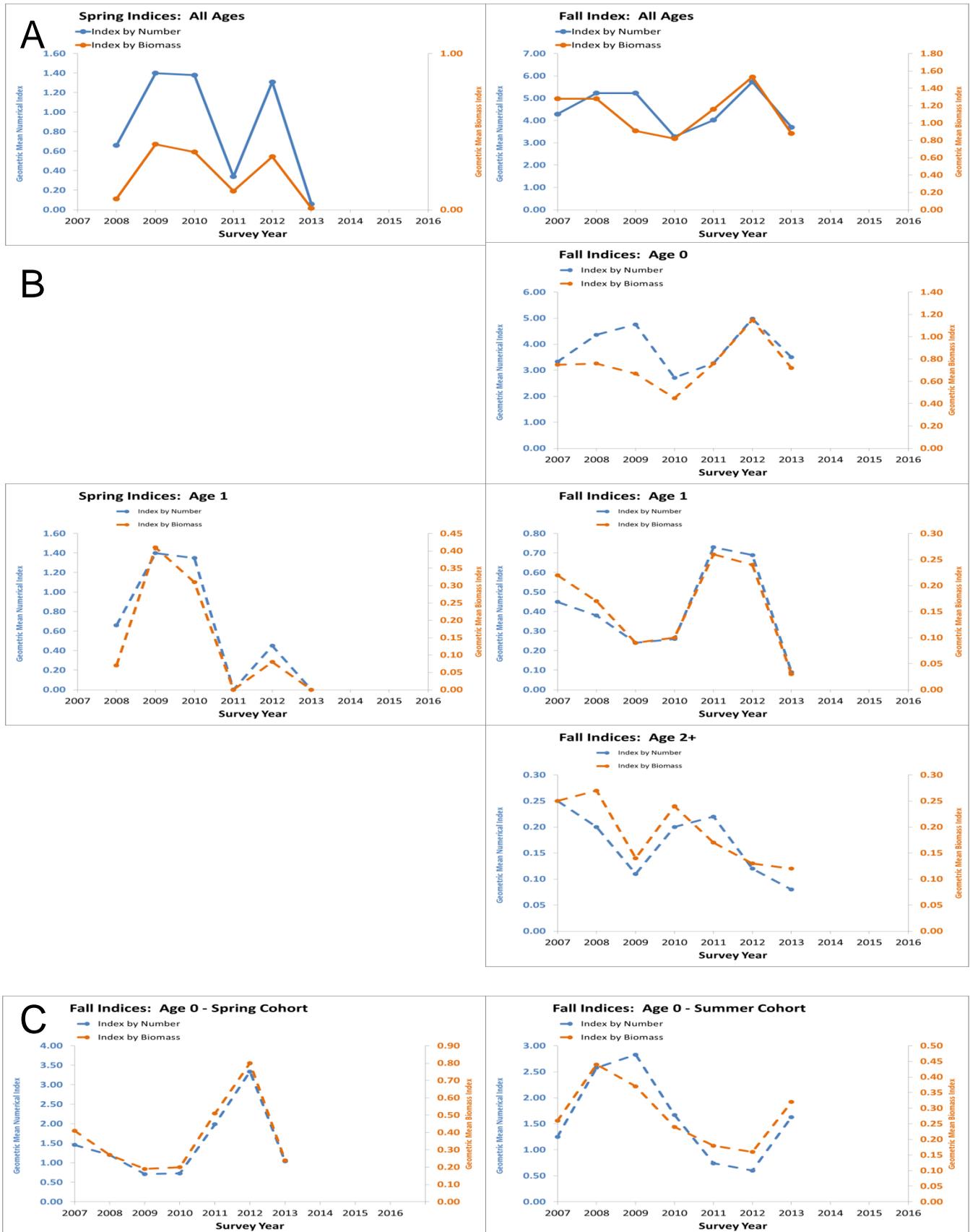


Figure 77. Bluefish length-frequency distributions, by cruise. (Blue reference line is placed at the size cutoff value – 17cm - used to separate the spring YOY cohort – to the right of the line – from the summer YOY cohort – to the left. Age-length key values were applied to the spring cohort specimens).

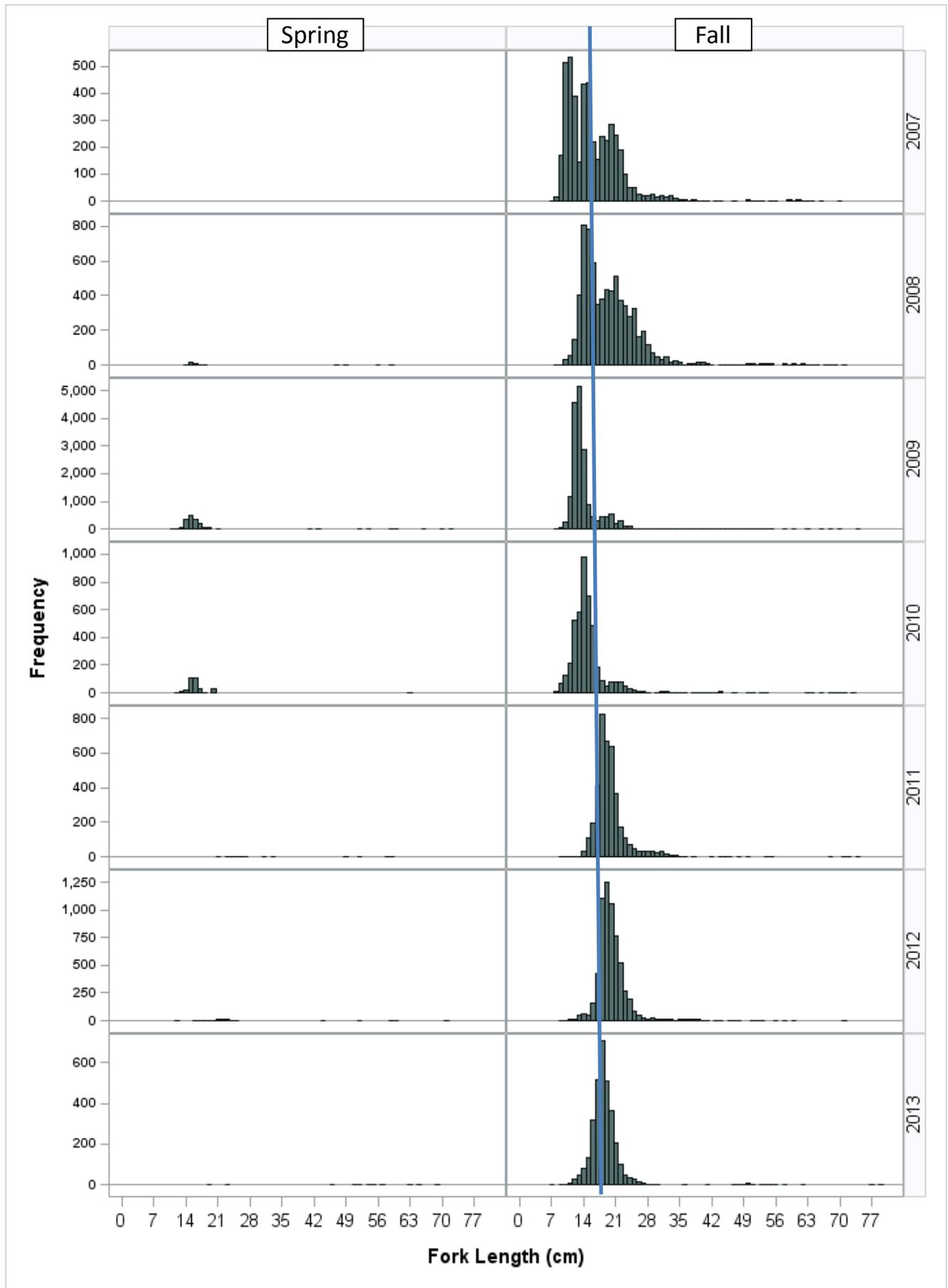


Figure 78. Bluefish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

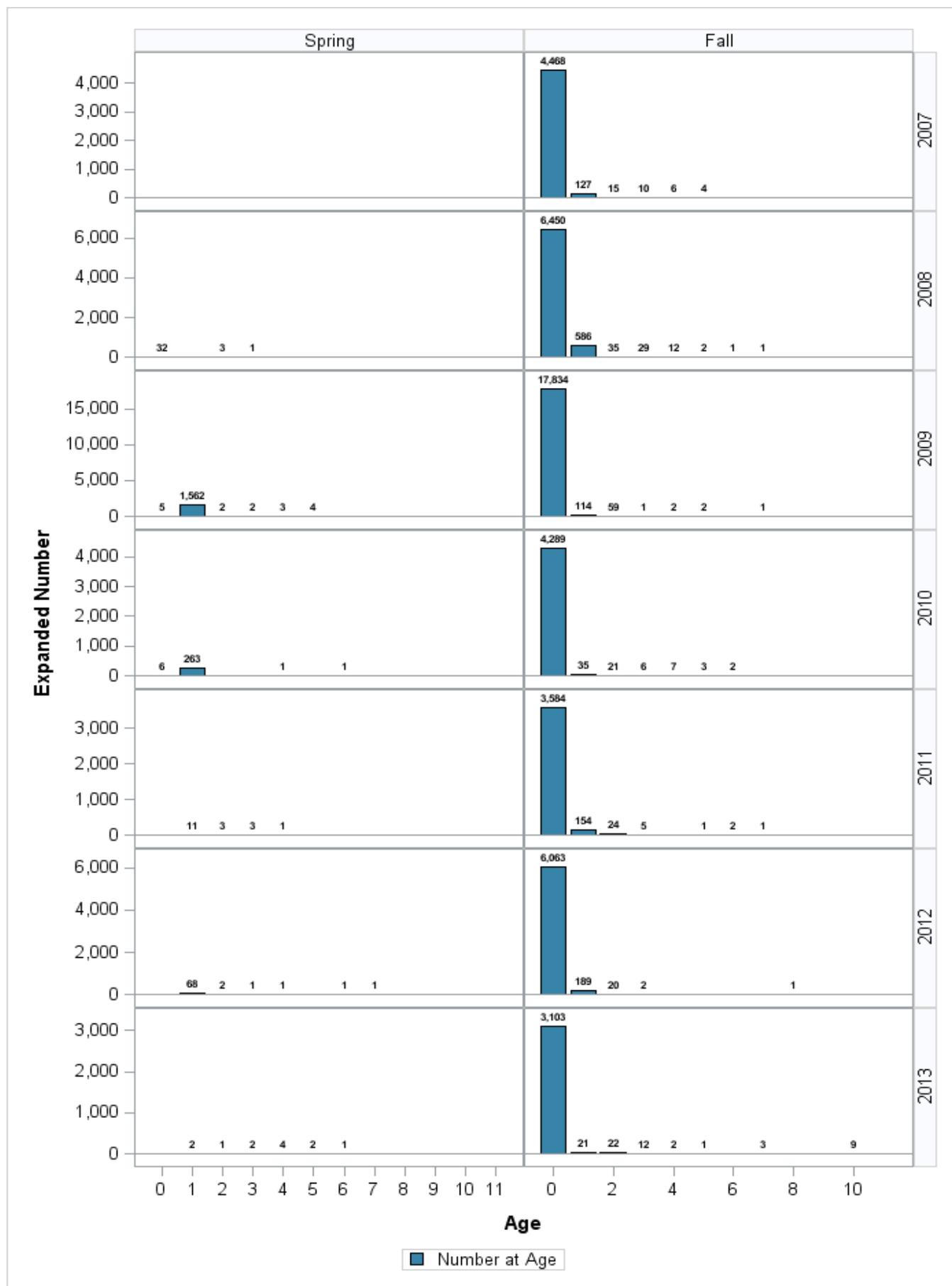


Figure 79. Bluefish catch-at-age standardized to 3,000 trawl minutes, by cruise.

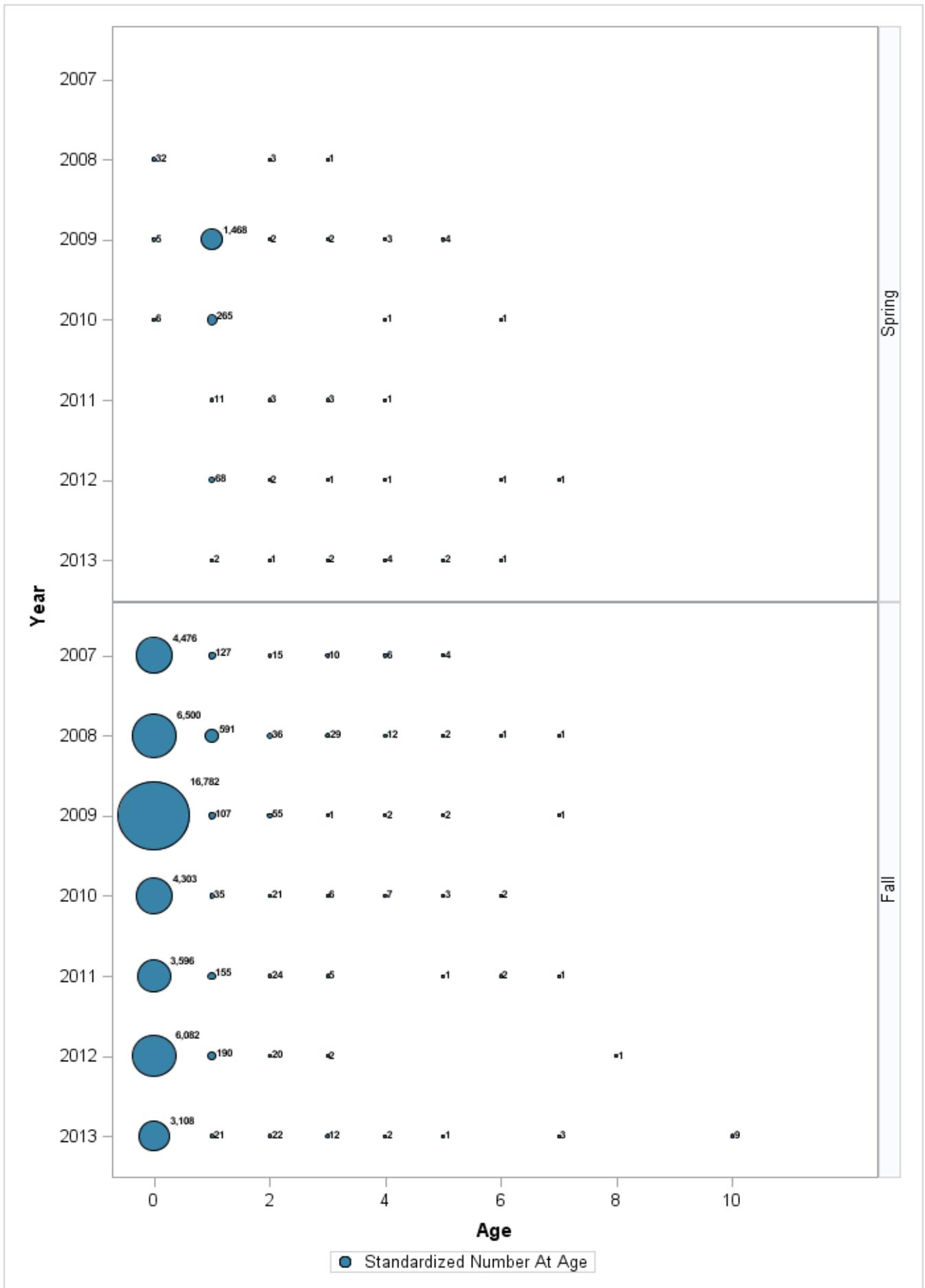


Figure 80. Bluefish sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

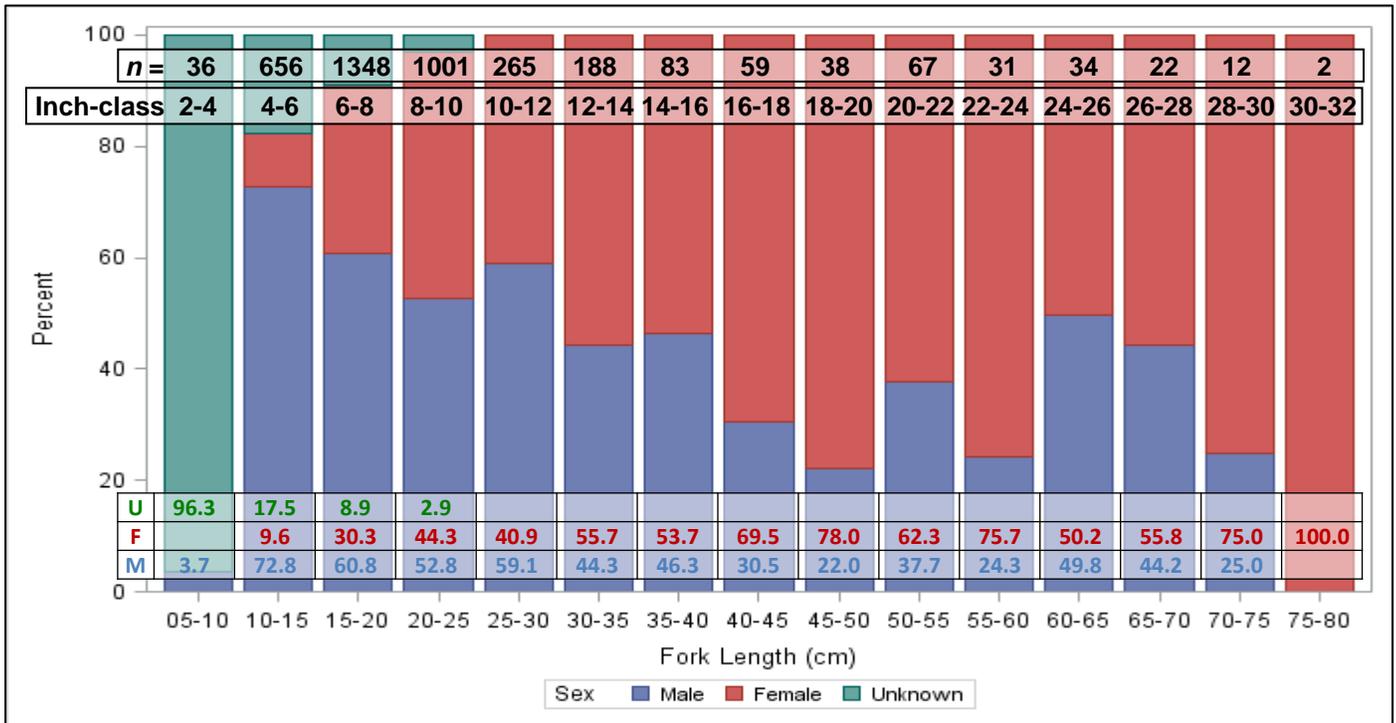


Figure 81. Bluefish maturity at length, by sex for all cruises pooled, 2007-2013.

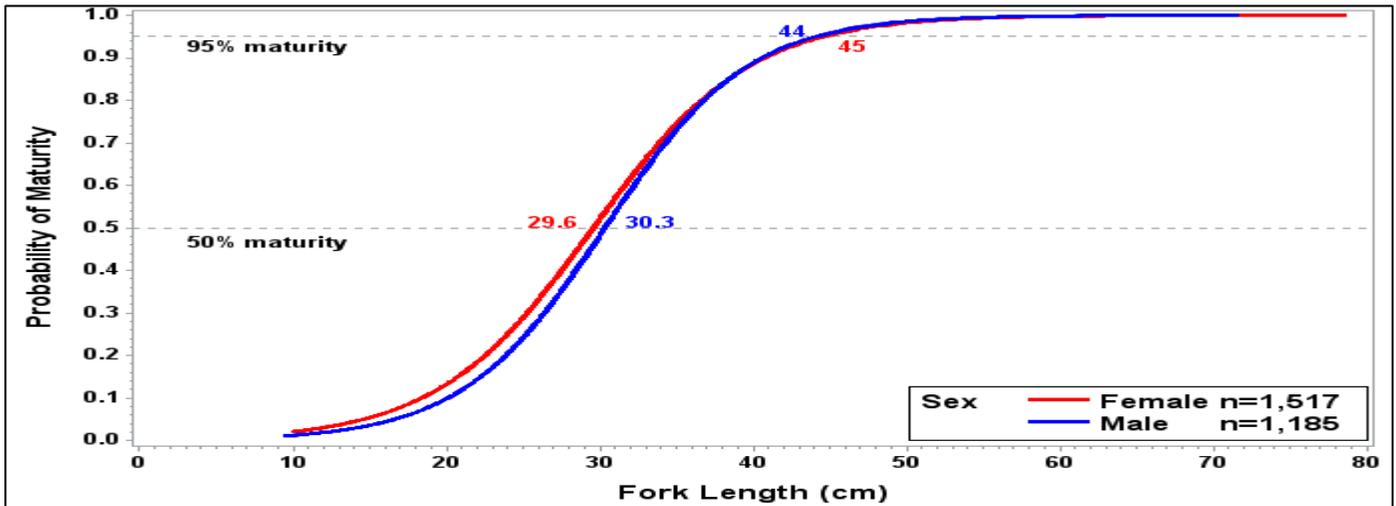


Figure 82. Bluefish maturity at age, by sex for all cruises pooled, 2007-2013.

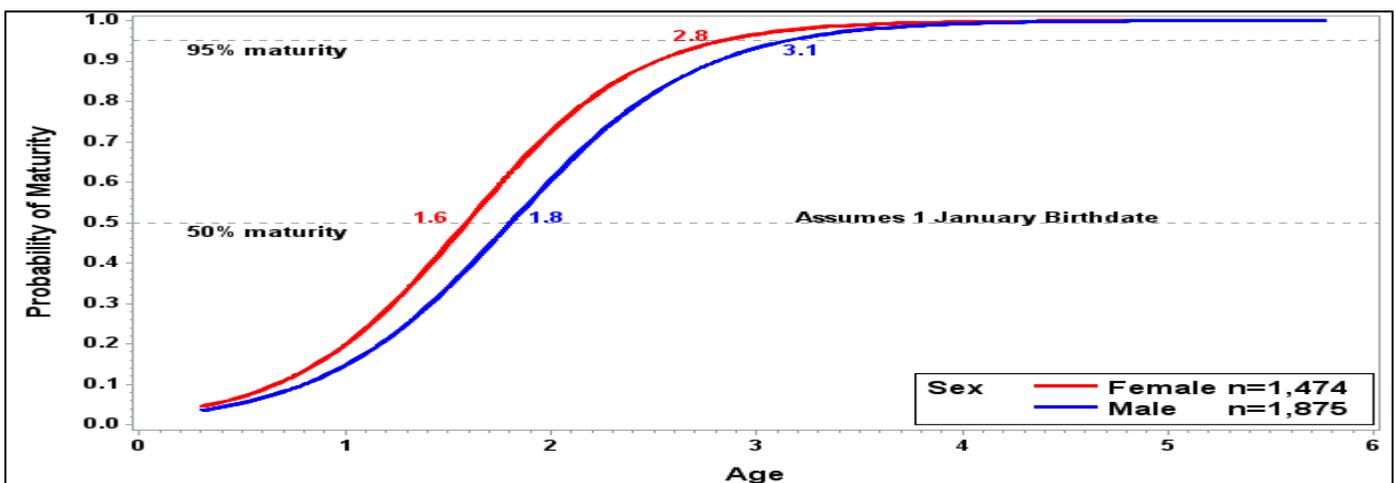
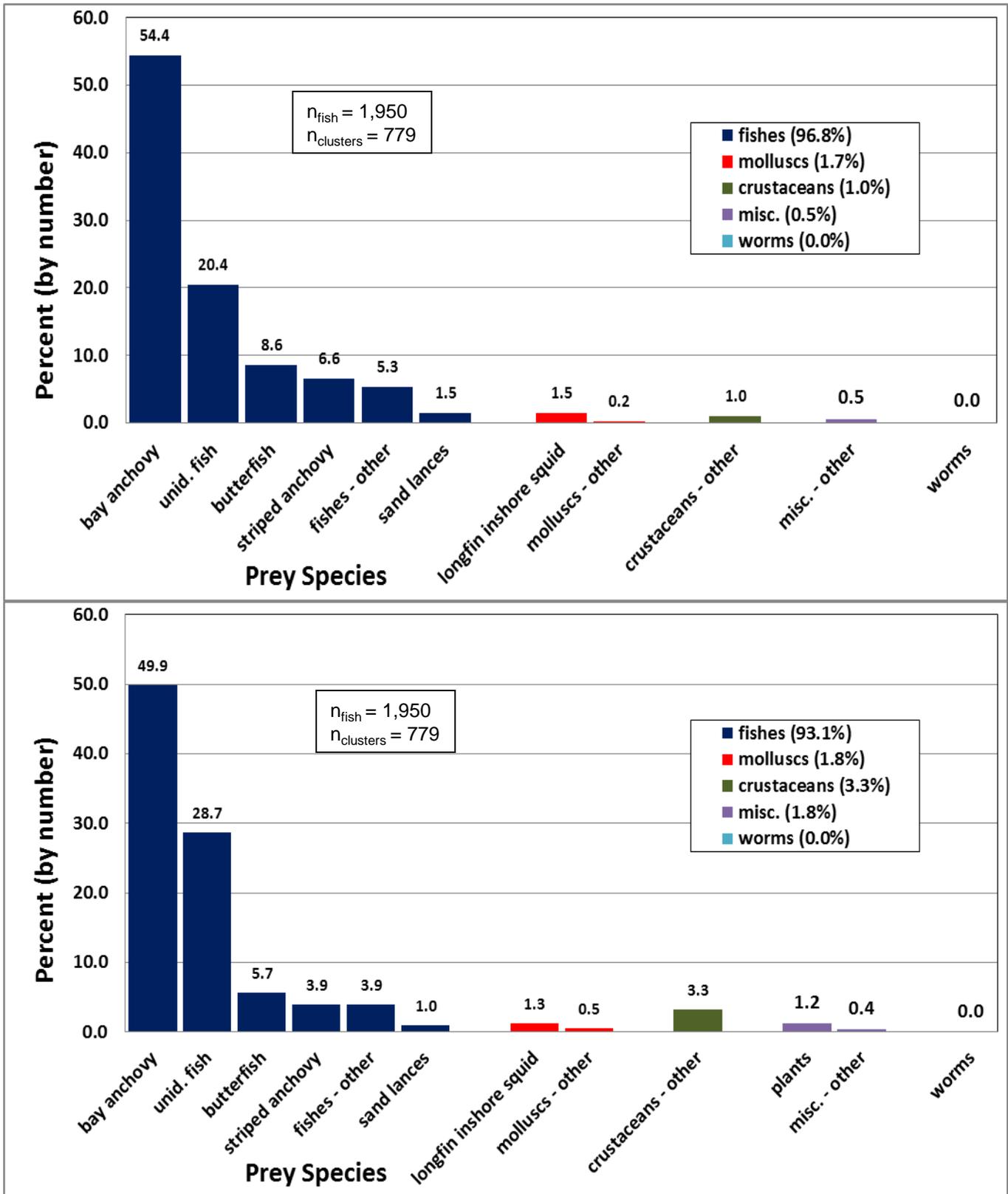


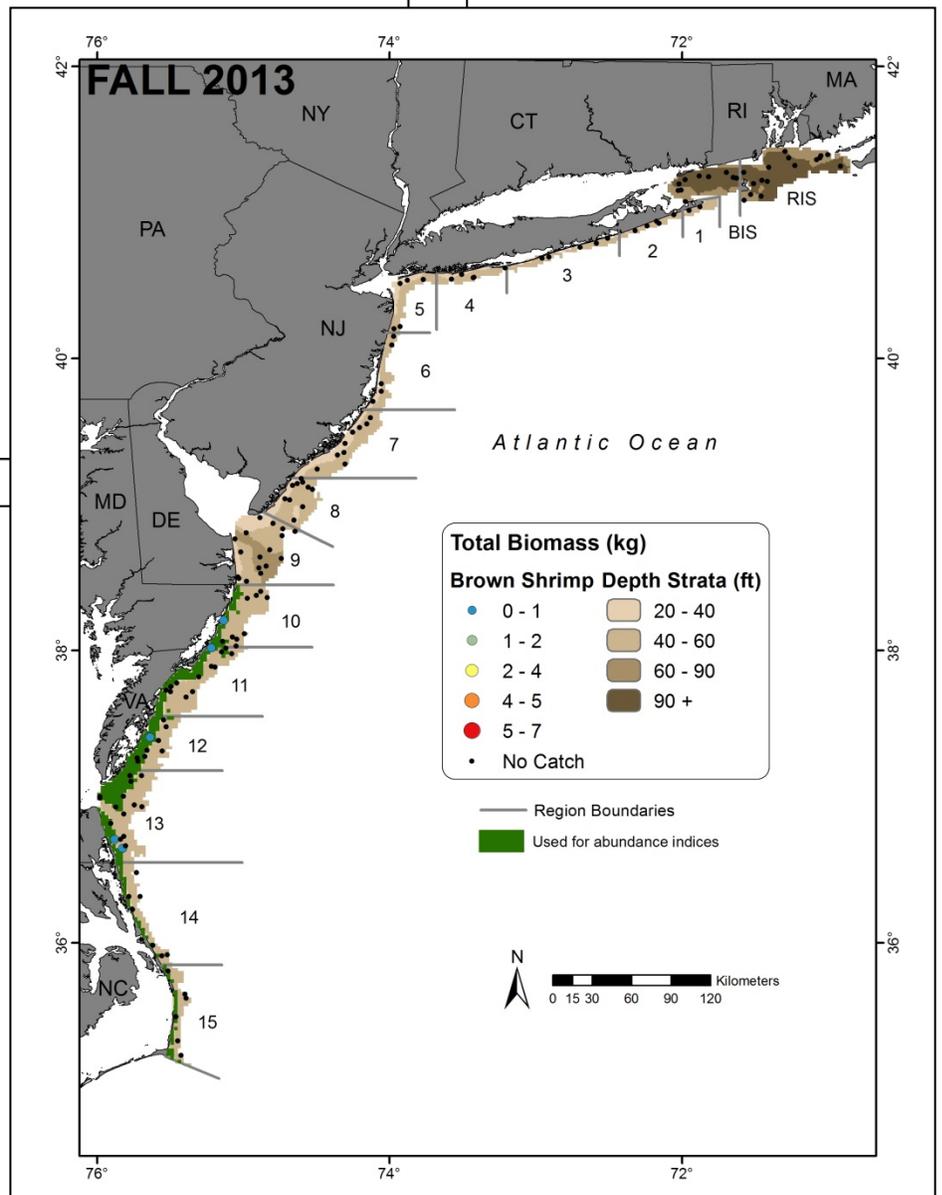
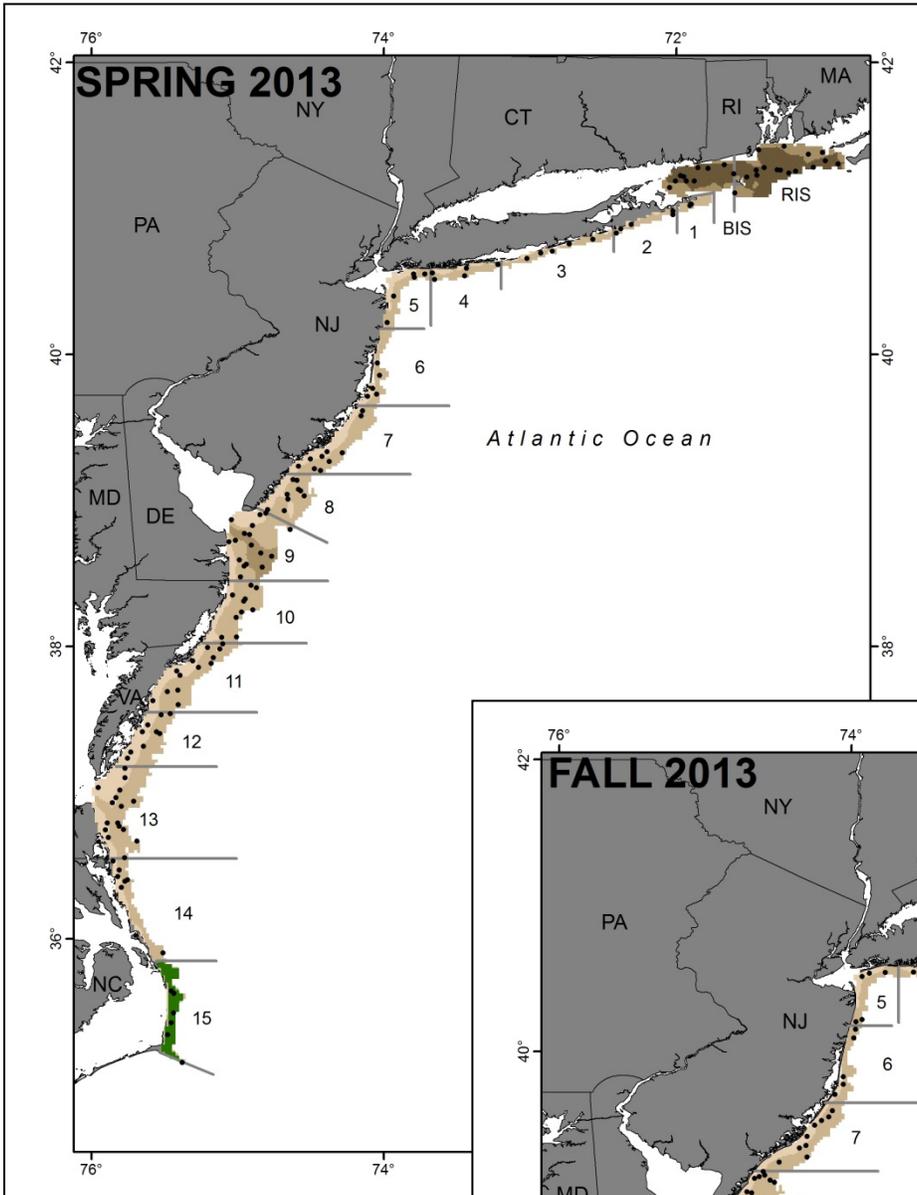
Figure 83. Bluefish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013 (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.).



Brown Shrimp

Sampling Priority: E

Figure 84. Brown Shrimp biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
		40-60		
NJ	04	20-40		
		40-60		
	05	20-40		
		40-60		
	06	20-40		
DE	07	20-40		
		40-60		
	08	20-40		
MD	09	20-40		
		40-60		
		60-90		
VA	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	12	20-40		
		40-60		
		40-60		
NC	13	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		40-60		
NC	15	20-40		
		40-60		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 30. Brown Shrimp sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	5	0.2	5	N/A	N/A	N/A	N/A
	2009	7	0.1	7	N/A	N/A	N/A	N/A
	2010	0	0.0	0	N/A	N/A	N/A	N/A
	2011	0	0.0	0	N/A	N/A	N/A	N/A
	2012	5	0.1	5	N/A	N/A	N/A	N/A
	2013	0	0.0	0	N/A	N/A	N/A	N/A
Fall	2007	898	21.6	459	N/A	N/A	N/A	N/A
	2008	509	15.3	372	N/A	N/A	N/A	N/A
	2009	45	0.9	45	N/A	N/A	N/A	N/A
	2010	79	1.3	21	N/A	N/A	N/A	N/A
	2011	406	10.2	406	N/A	N/A	N/A	N/A
	2012	286	6.4	286	N/A	N/A	N/A	N/A
	2013	8	0.2	8	N/A	N/A	N/A	N/A

Table 31. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	23	1.64	4.32	9.71	0.18	0.39	0.62
	2008	6	0.00	0.60	1.59	0.00	0.03	0.05		2008	22	0.94	2.80	6.43	0.04	0.23	0.45
	2009	7	0.00	0.17	0.40	0.00	0.01	0.02		2009	25	0.04	0.46	1.04	0.00	0.02	0.03
	2010	6	0.00	0.00	0.00	0.00	0.00	0.00		2010	22	0.05	0.27	0.54	0.00	0.03	0.06
	2011	6	0.00	0.00	0.00	0.00	0.00	0.00		2011	22	1.96	3.51	5.87	0.14	0.20	0.27
	2012	6	0.04	0.44	1.00	0.00	0.01	0.02		2012	22	1.61	3.34	6.22	0.08	0.19	0.30
	2013	6	0.00	0.00	0.00	0.00	0.00	0.00		2013	22	0.00	0.15	0.35	0.00	0.01	0.03
	2014									2014							
	2015									2015							
	2016									2016							

Figure 85. Brown Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

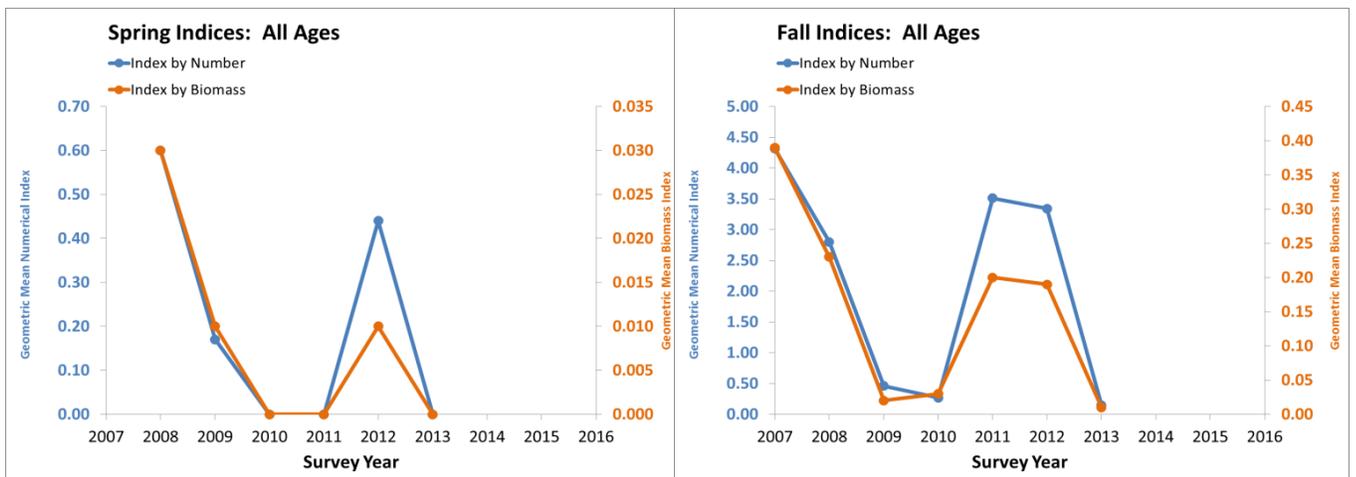
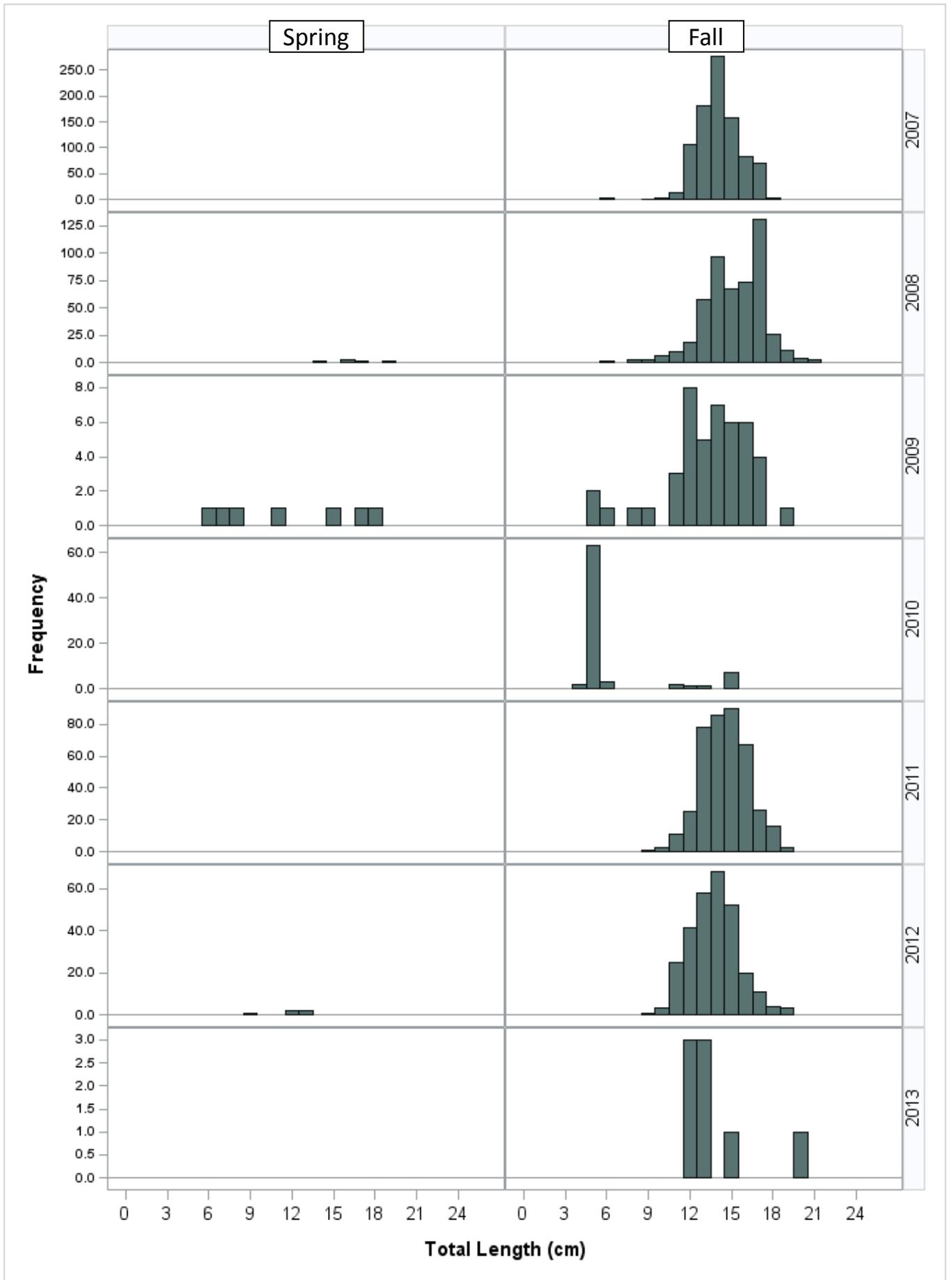


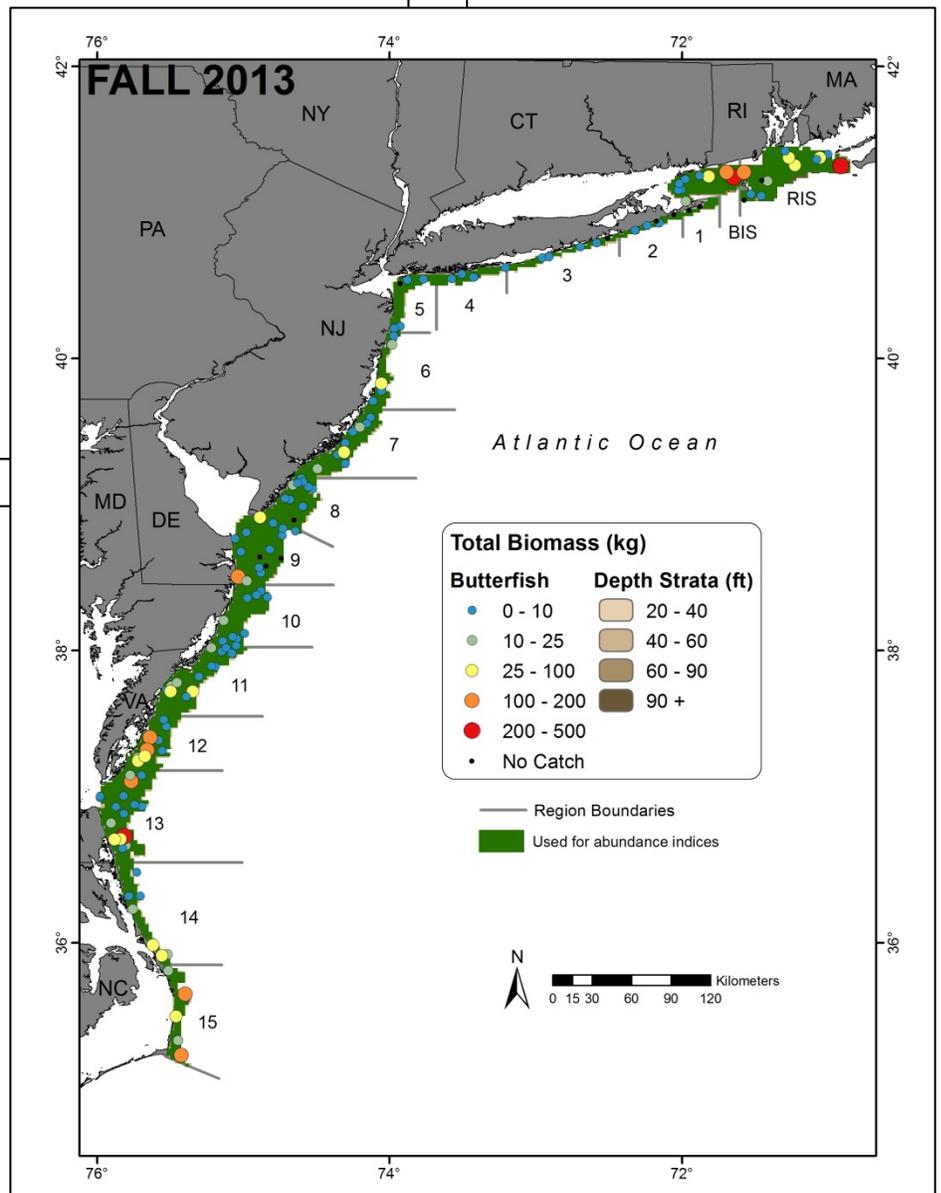
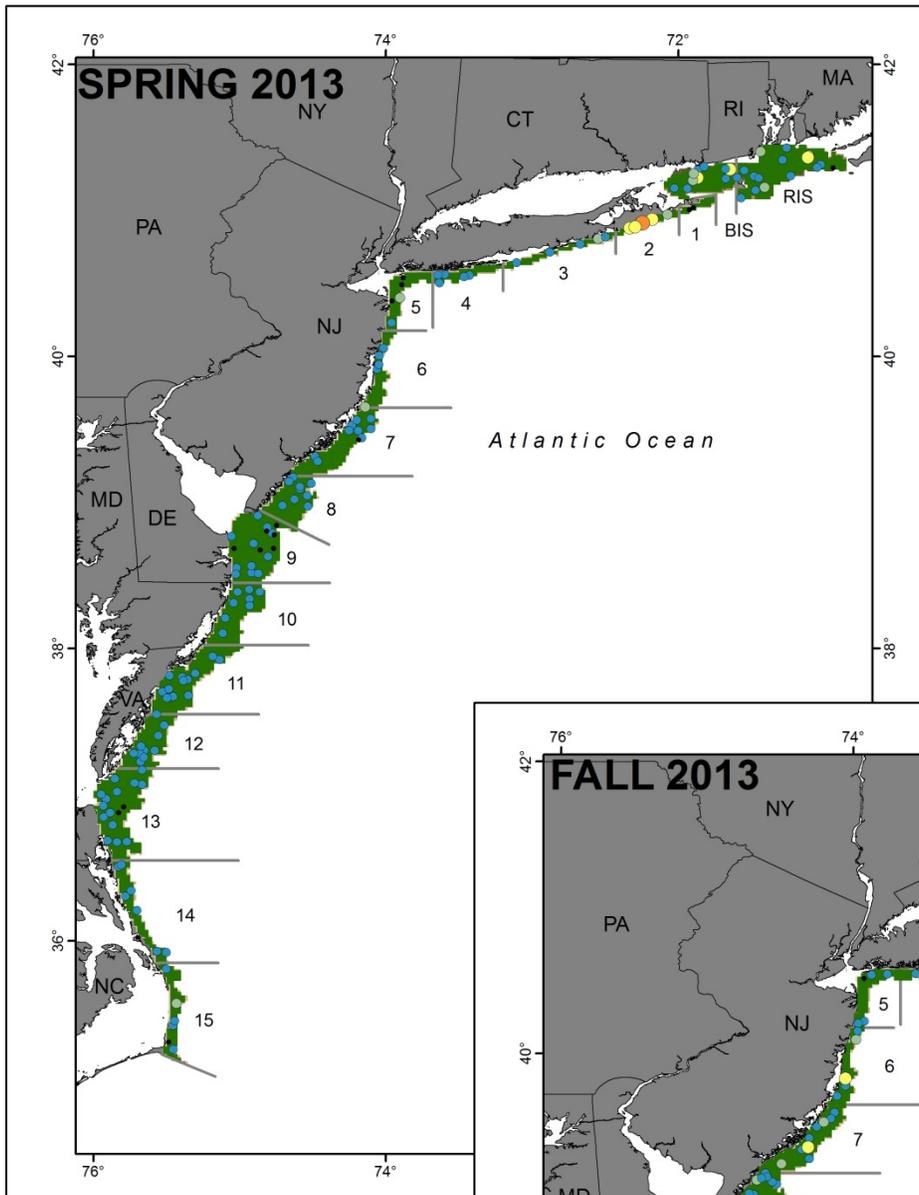
Figure 86. Brown Shrimp length-frequency distributions, by cruise.



Butterfish

Sampling Priority: A

Figure 87. Butterfish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
	02	20-40		
		40-60		
		20-40		
		40-60		
		20-40		
	03	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
	04	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
	05	20-40		
		40-60		
		20-40		
		40-60		
		20-40		
NJ	06	20-40		
		40-60		
		20-40		
	07	20-40		
		40-60		
		20-40		
	08	20-40		
		40-60		
		20-40		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		20-40		
	12	20-40		
		40-60		
		20-40		
	13	20-40		
		40-60		
		20-40		
NC	14	20-40		
		40-60		
		20-40		
	15	20-40		
		40-60		
		20-40		

= used for abundance indices
 = not used for abundance indices

Table 32. Butterfish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	47,747	689.3	8,320	751	751	5	0
	2009	35,588	816.5	16,089	1,048	1,048	0	0
	2010	64,291	2,136.2	11,212	740	740	0	0
	2011	66,089	1,464.5	17,806	766	766	0	0
	2012	70,051	2,970.2	15,328	675	675	0	0
	2013	10,476	678.6	6,033	457	0	0	0
Fall	2007	148,182	1,904.9	6,015	538	0	11	0
	2008	168,270	2,120.7	10,091	551	551	8	0
	2009	544,718	8,677.5	20,670	774	774	0	0
	2010	157,706	4,957.3	19,276	693	693	0	0
	2011	234,974	5,245.4	15,489	499	499	0	0
	2012	95,872	3,938.1	12,744	544	544	1	0
	2013	433,403	5,906.1	21,296	661	0	0	0

Table 33. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	150	50.33	68.18	92.25	2.15	2.81	3.61
	2008	150	31.78	44.17	61.22	1.80	2.29	2.86	2008	150	147.98	198.86	267.11	3.62	4.64	5.87	
	2009	160	50.68	63.04	78.34	1.59	1.94	2.34	2009	160	125.73	164.08	214.04	4.67	5.82	7.20	
	2010	150	24.55	35.71	51.75	1.55	2.17	2.95	2010	150	161.01	212.18	279.51	5.91	7.64	9.81	
	2011	150	76.44	103.87	141.01	2.47	3.17	4.02	2011	150	75.67	105.54	147.07	5.62	7.22	9.20	
	2012	150	103.43	135.04	176.21	5.36	6.91	8.84	2012	150	28.37	39.63	55.19	2.78	3.74	4.94	
	2013	150	9.18	11.48	14.31	0.96	1.18	1.42	2013	150	64.46	95.35	140.81	3.68	5.29	7.44	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	150	29.45	38.97	51.47	1.07	1.39	1.75
	2008	150	1.70	2.51	3.56	0.05	0.10	0.16	2008	150	69.07	89.67	116.31	1.82	2.27	2.78	
	2009	160	4.72	5.80	7.08	0.06	0.08	0.09	2009	160	35.67	46.01	59.26	1.53	1.86	2.24	
	2010	150	0.78	1.08	1.42	0.01	0.03	0.05	2010	150	64.01	81.87	104.64	2.18	2.66	3.20	
	2011	150	12.06	16.41	22.21	0.34	0.46	0.60	2011	150	38.92	52.30	70.17	2.98	3.74	4.63	
	2012	150	1.06	1.48	1.98	0.02	0.03	0.04	2012	150	12.78	16.99	22.49	1.23	1.60	2.03	
	2013	150	0.08	0.20	0.33	0.00	0.00	0.00	2013	150	22.13	31.90	45.80	1.00	1.45	2.01	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007								1	2007	150	11.59	15.84	21.54	1.03	1.39	1.81
	2008	150	10.03	13.65	18.47	0.64	0.83	1.04	2008	150	31.82	44.70	62.62	1.47	1.90	2.40	
	2009	160	30.23	38.78	49.67	1.12	1.38	1.66	2009	160	44.78	59.04	77.73	2.32	2.97	3.74	
	2010	150	11.64	16.46	23.10	0.77	1.08	1.46	2010	150	36.92	50.73	69.57	2.53	3.34	4.33	
	2011	150	17.73	23.56	31.20	1.18	1.52	1.90	2011	150	24.47	33.98	47.03	2.56	3.34	4.28	
	2012	150	60.44	80.45	106.96	3.64	4.69	5.98	2012	150	9.21	13.20	18.77	1.45	1.98	2.62	
	2013	150	3.08	3.78	4.60	0.32	0.41	0.50	2013	150	18.14	28.06	43.11	2.25	3.21	4.44	
	2014								2014								
	2015								2015								
	2016								2016								
2+	2007								2+	2007	150	4.26	6.10	8.58	0.73	1.02	1.37
	2008	150	17.10	23.40	31.89	1.25	1.58	1.96	2008	150	7.15	9.79	13.28	0.52	0.69	0.88	
	2009	160	6.05	7.66	9.62	0.50	0.65	0.83	2009	160	4.83	6.71	9.20	0.65	0.89	1.16	
	2010	150	12.41	18.03	25.99	1.00	1.44	1.97	2010	150	11.61	17.09	24.96	1.80	2.44	3.24	
	2011	150	7.93	10.69	14.31	0.91	1.23	1.60	2011	150	6.09	8.11	10.71	0.70	0.95	1.23	
	2012	150	29.07	39.02	52.26	2.21	2.84	3.61	2012	150	4.41	6.17	8.50	0.73	1.01	1.34	
	2013	150	6.49	8.15	10.17	0.77	0.94	1.13	2013	150	9.39	14.21	21.26	1.57	2.21	3.00	
	2014								2014								
	2015								2015								
	2016								2016								

Figure 88. Butterfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).



Figure 89. Butterfish length-frequency distributions, by cruise.

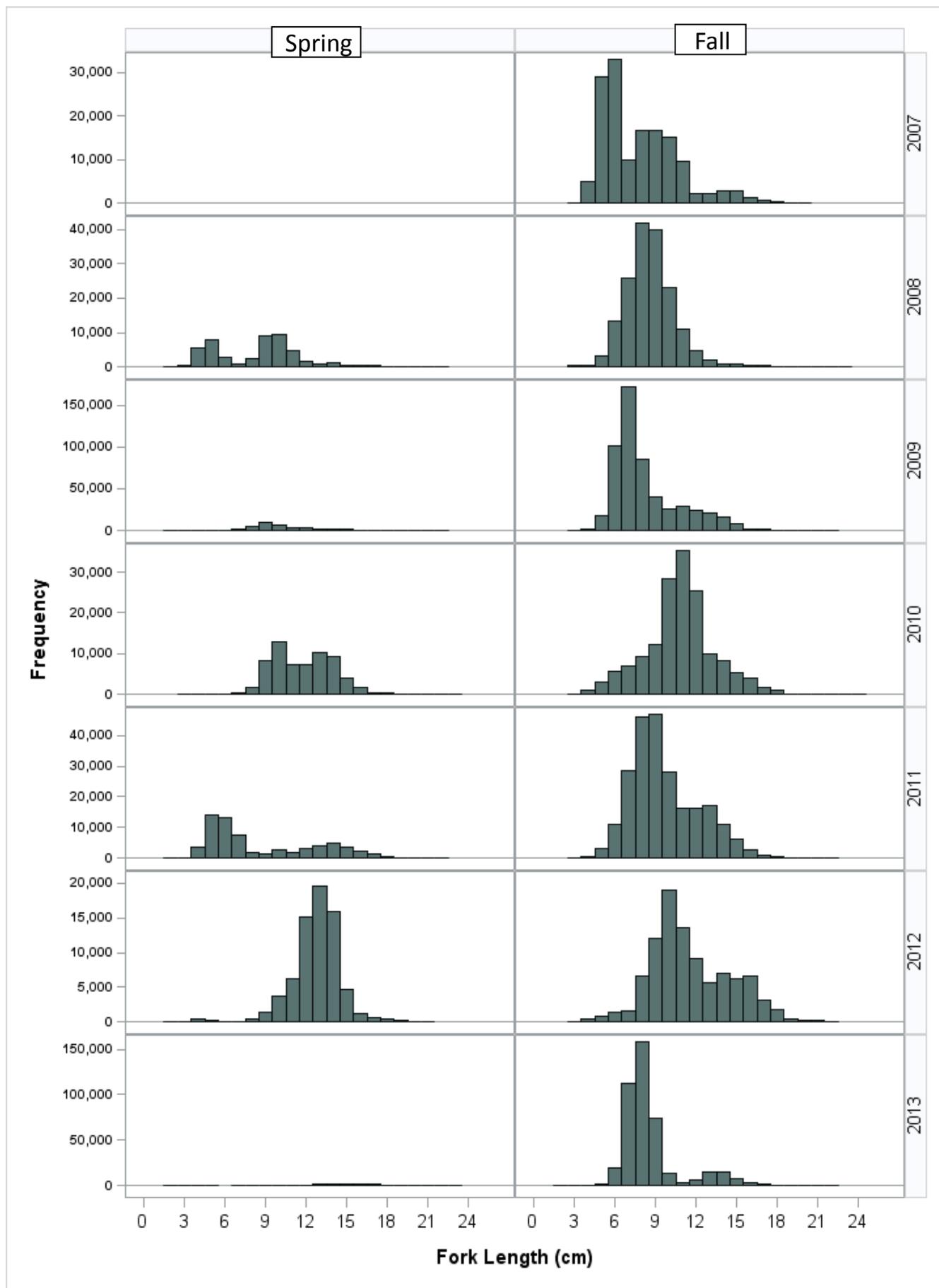


Figure 90. Butterfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar. Values in red were generated by application of age-length keys.)

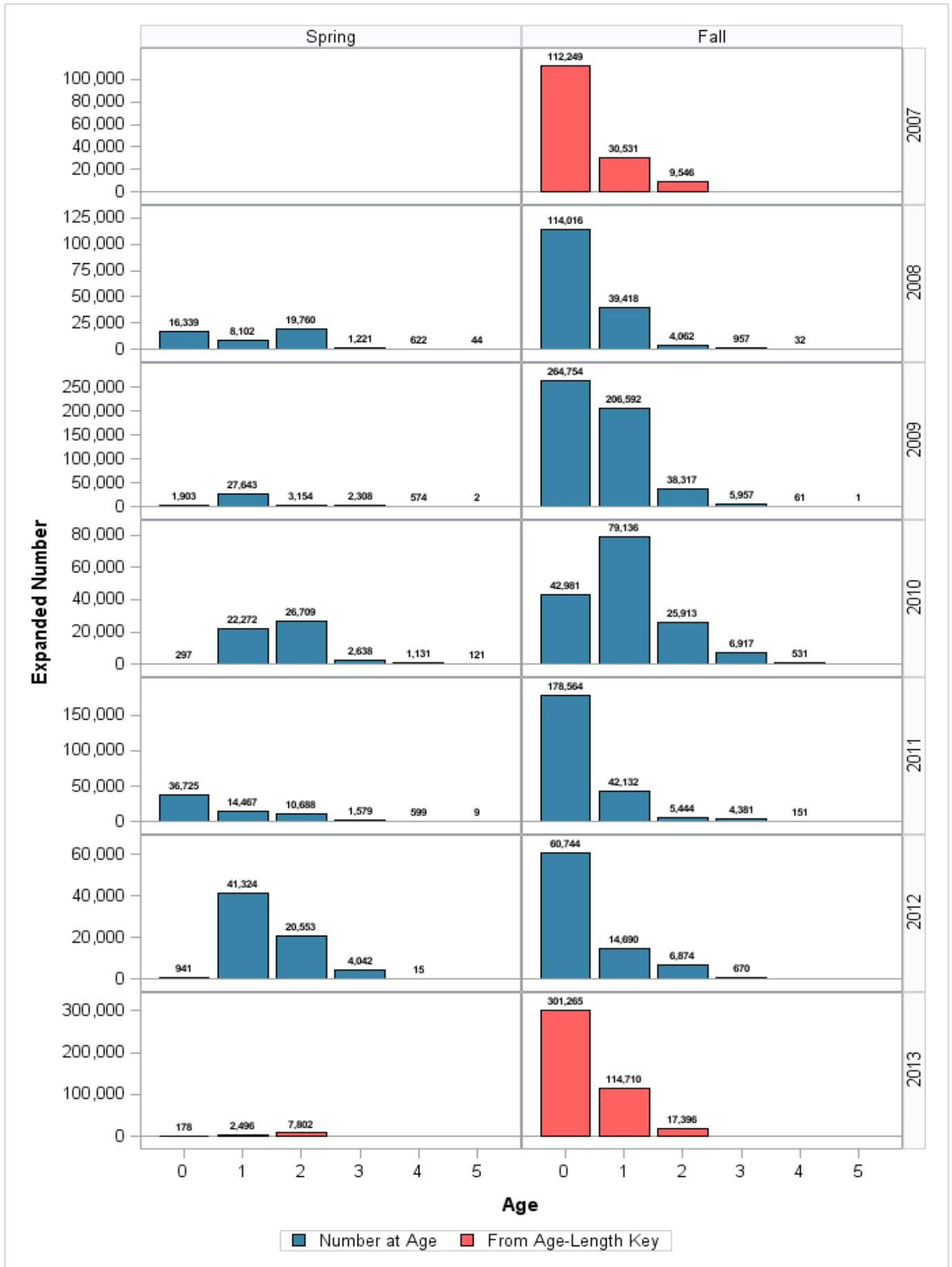


Figure 91. Butterfish catch-at-age standardized to 3,000 trawl minutes, by cruise. Values in red were generated by application of age-length keys.)

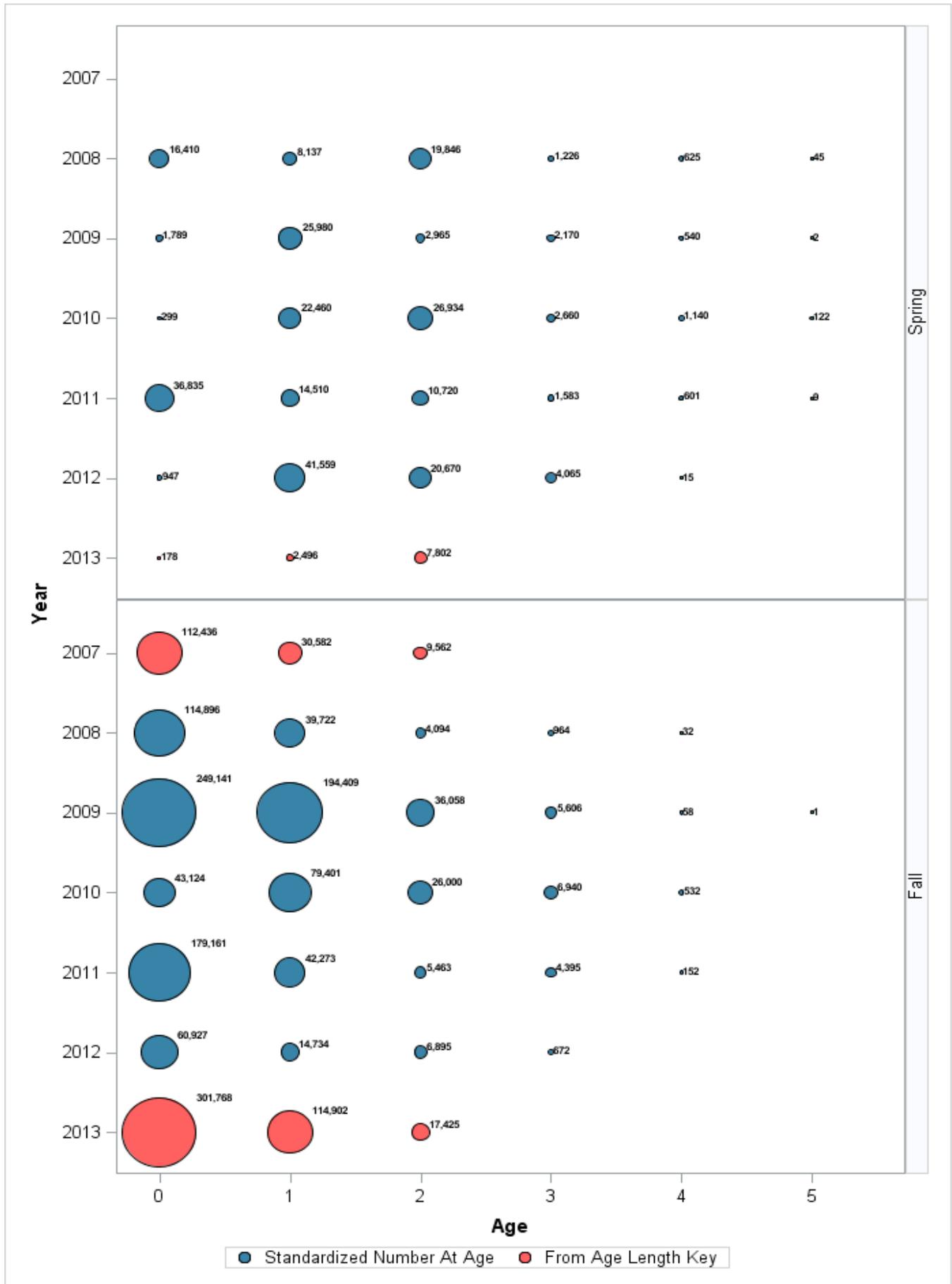


Figure 92. Butterfish sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

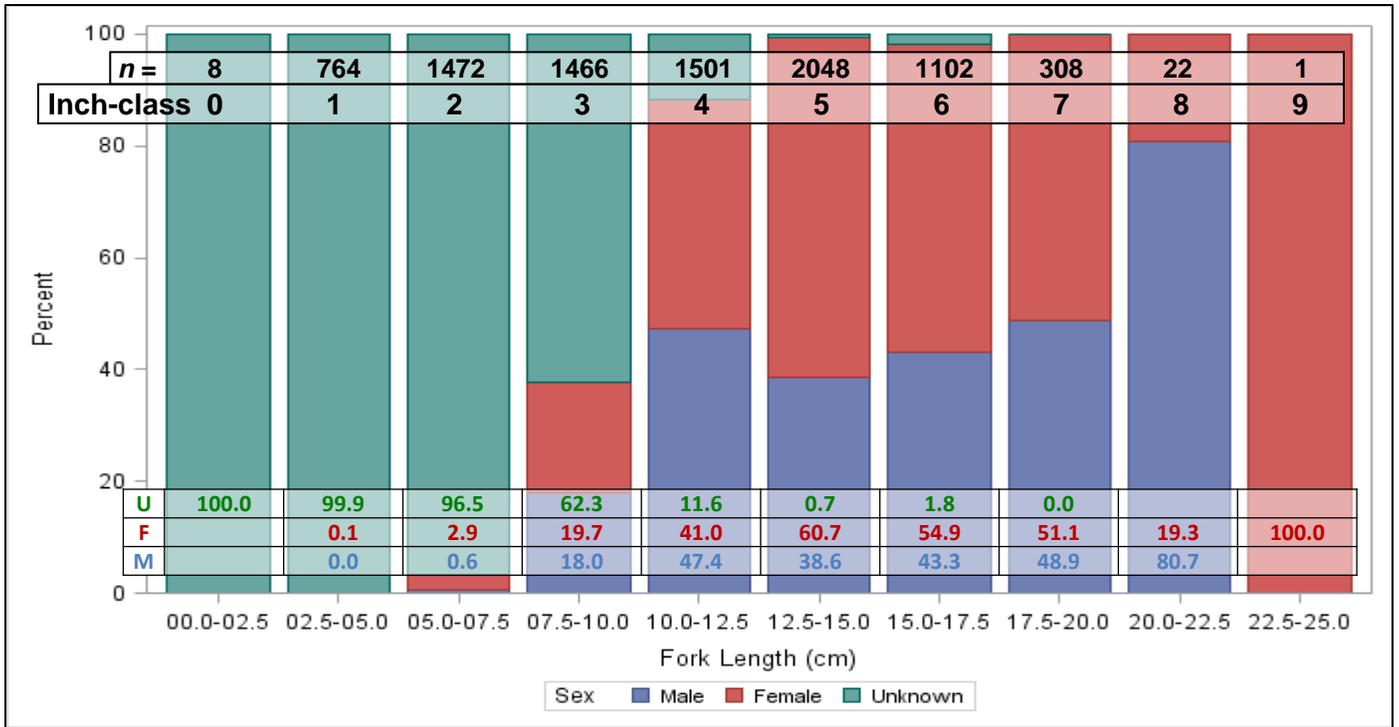


Figure 93. Butterfish maturity at length, by sex for all cruises pooled, 2007-2013.

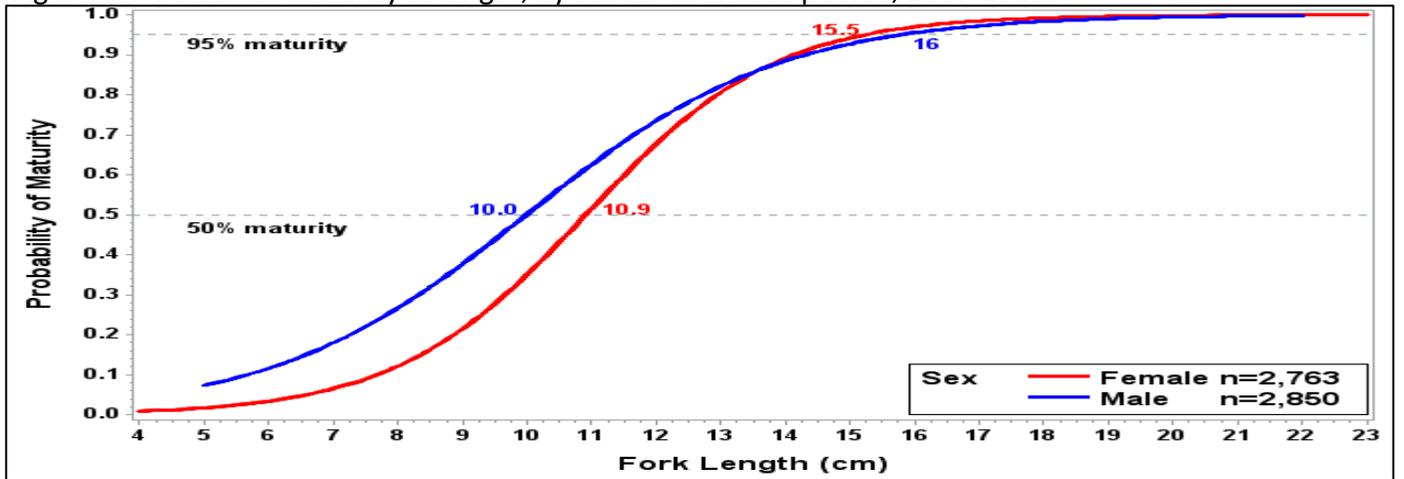
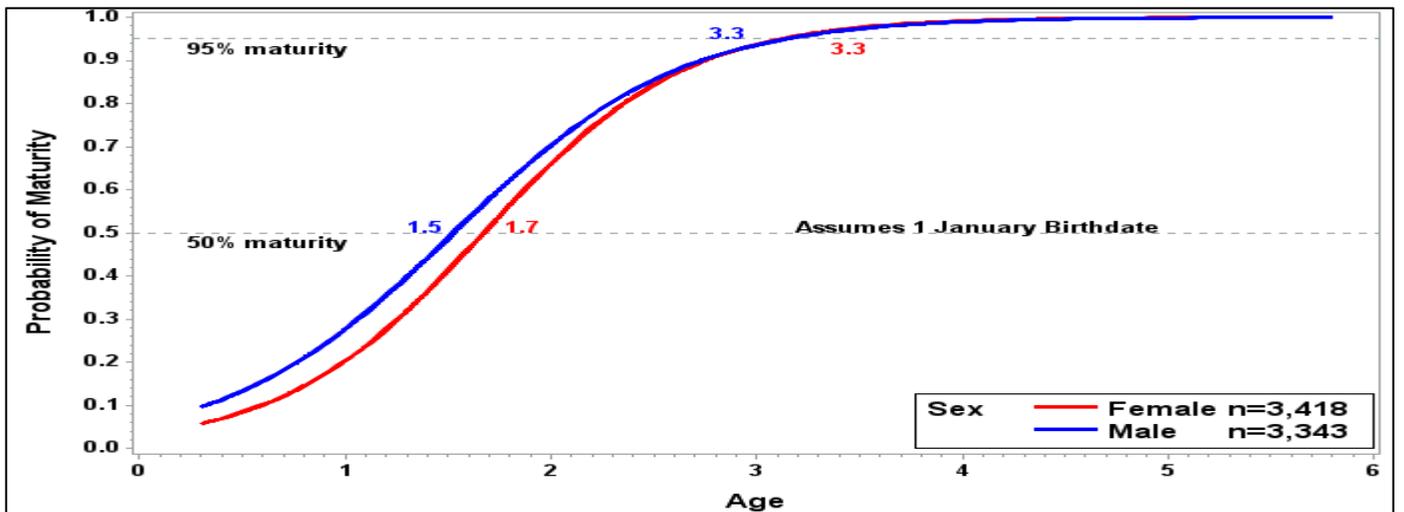


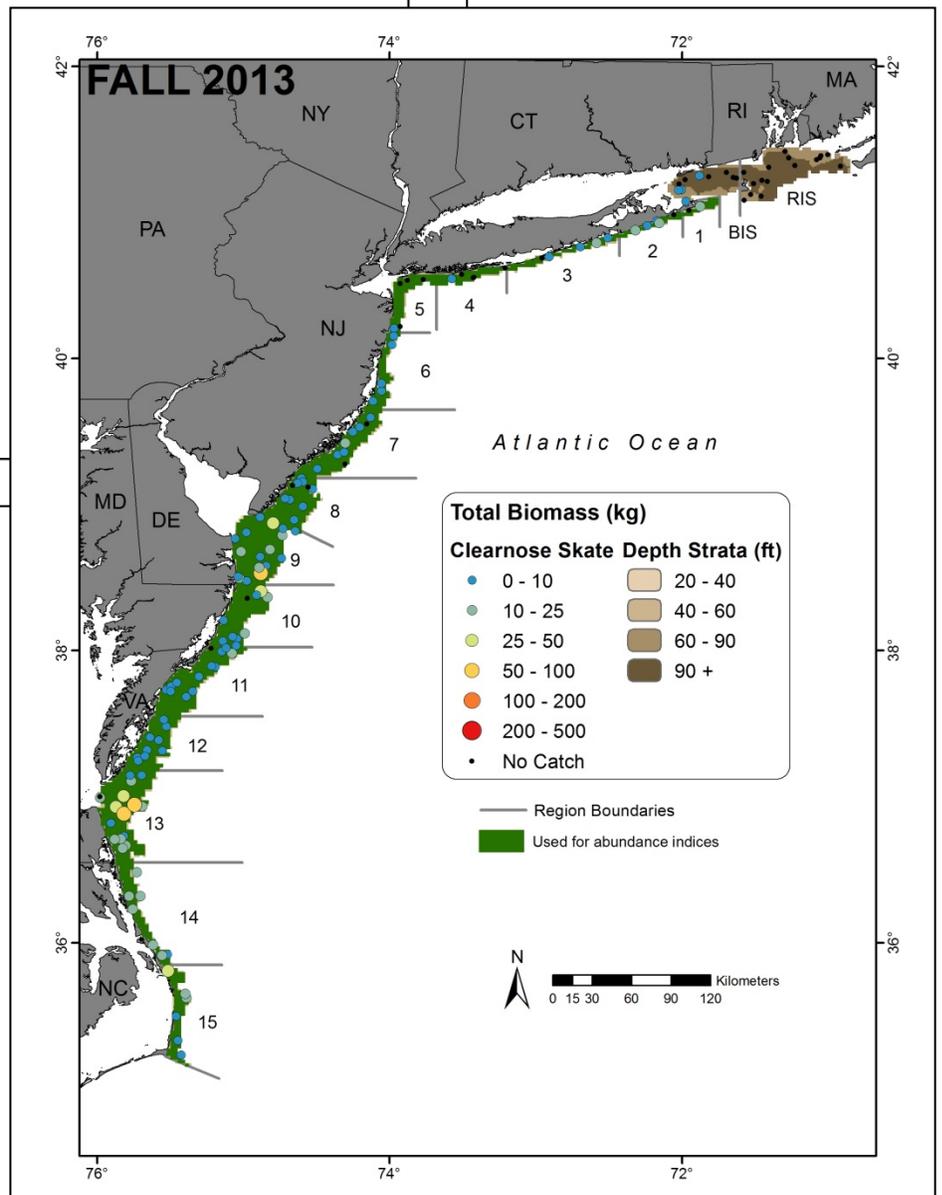
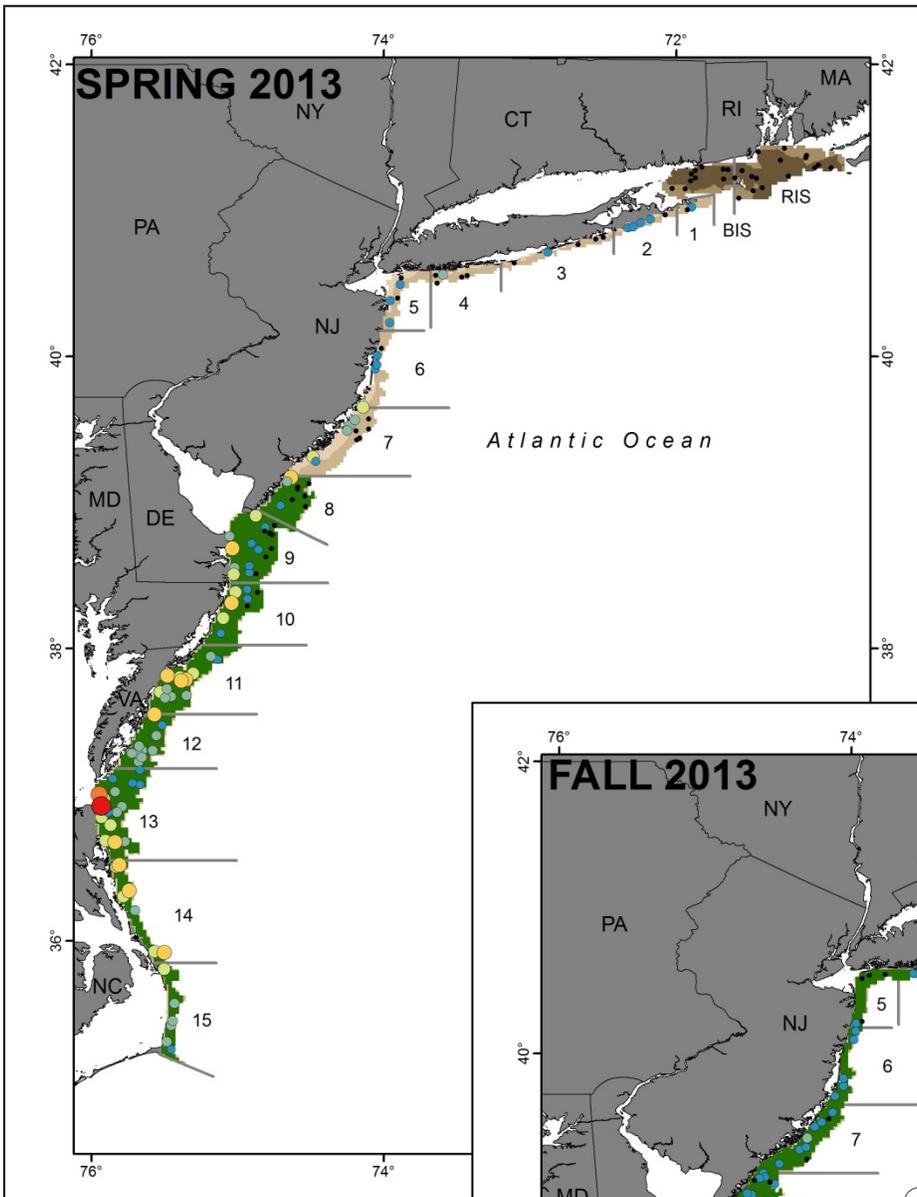
Figure 94. Butterfish maturity at age, by sex for all cruises pooled, 2007-2013.



Clearnose Skate

Sampling Priority: A

Figure 95. Clearnose Skate biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
NY	01	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
NJ	06	20-40		
		40-60		
		20-40		
		40-60		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 34. Clearnose Skate sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	3,219	4,237.3	1,050	212	0	207	205
	2009	2,429	3,388.3	1,431	205	0	188	183
	2010	1,702	2,517.9	1,353	197	0	183	176
	2011	2,216	2,744.8	1,854	211	0	190	190
	2012	2,356	3,072.1	2,014	270	0	248	235
	2013	2,309	3,072.5	1,715	250	0	216	201
Fall	2007	1,505	1,854.6	1,361	346	0	330	294
	2008	885	1,196.2	806	289	0	287	287
	2009	1,107	1,355.1	1,007	335	0	308	302
	2010	875	1,056.7	875	307	0	278	274
	2011	1,178	1,357.7	1,110	318	0	291	283
	2012	1,808	2,342.3	1,808	346	0	309	289
	2013	906	1,182.1	906	291	0	264	0

Table 35. Clearnose sSkate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey						Fall Survey											
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	124	6.45	7.61	8.96	7.54	9.01	10.72
	2008	86	9.88	12.13	14.86	11.69	14.44	17.79		2008	124	3.93	4.60	5.37	4.69	5.62	6.69
	2009	91	5.41	7.00	8.98	6.70	8.81	11.50		2009	134	4.86	5.70	6.65	5.60	6.61	7.77
	2010	87	6.18	7.52	9.11	7.62	9.38	11.51		2010	124	4.01	4.75	5.59	4.66	5.50	6.47
	2011	87	7.82	9.73	12.05	8.93	11.32	14.28		2011	124	5.85	6.72	7.70	6.62	7.62	8.74
	2012	87	8.62	10.83	13.54	10.35	13.14	16.62		2012	124	8.78	10.15	11.71	10.67	12.42	14.43
	2013	87	7.56	9.60	12.13	8.94	11.47	14.65		2013	124	3.94	4.84	5.90	4.73	5.84	7.18
	2014									2014							
	2015									2015							
	2016									2016							

Figure 96. Clearnose Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

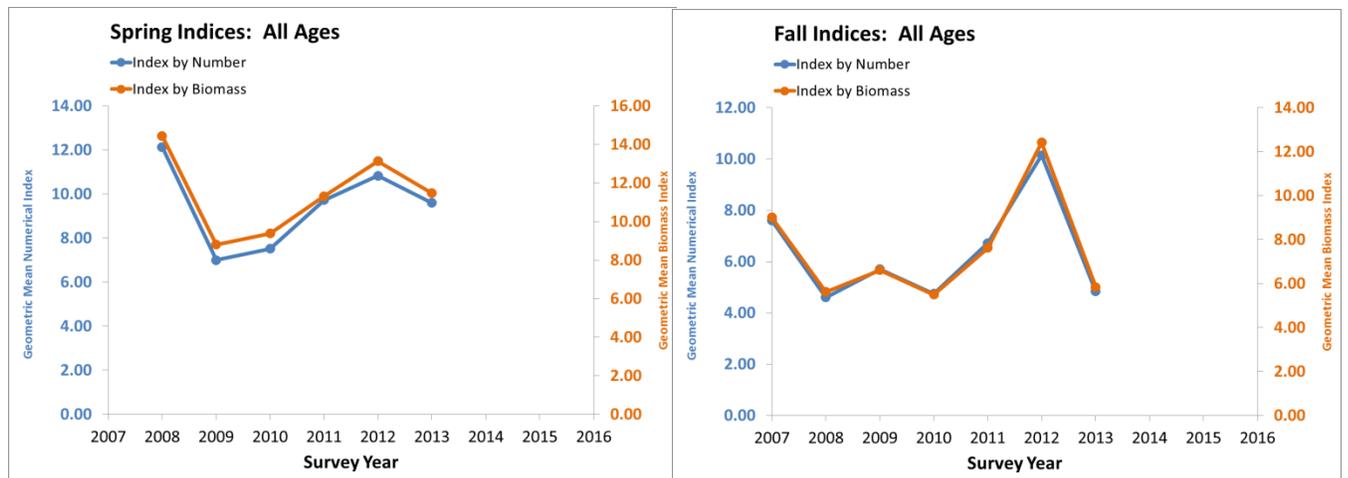


Figure 97. Clearnose Skate width-frequency distributions, by cruise.

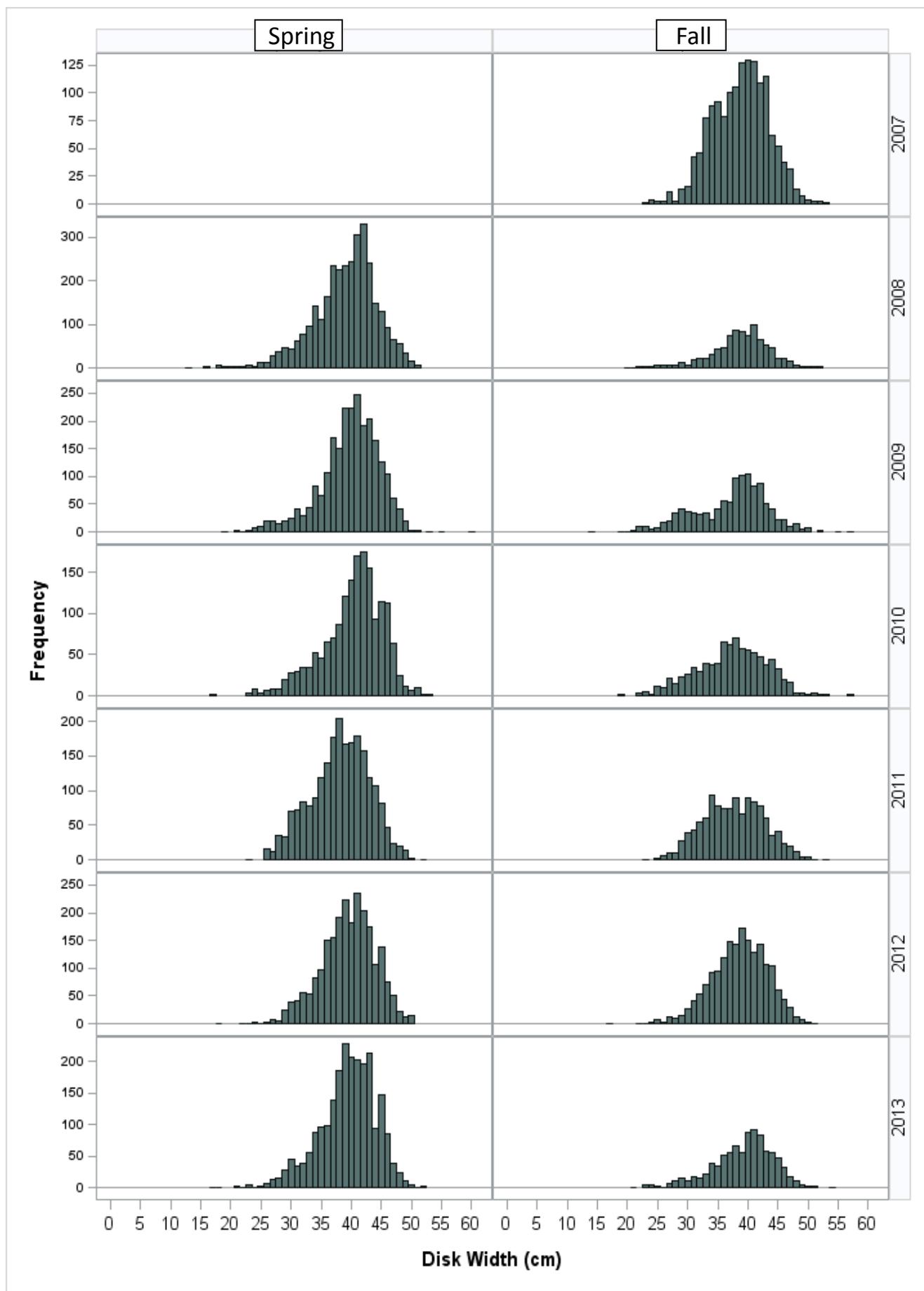


Figure 98. Clearnose Skate width-frequency distributions, by cruise and sex.

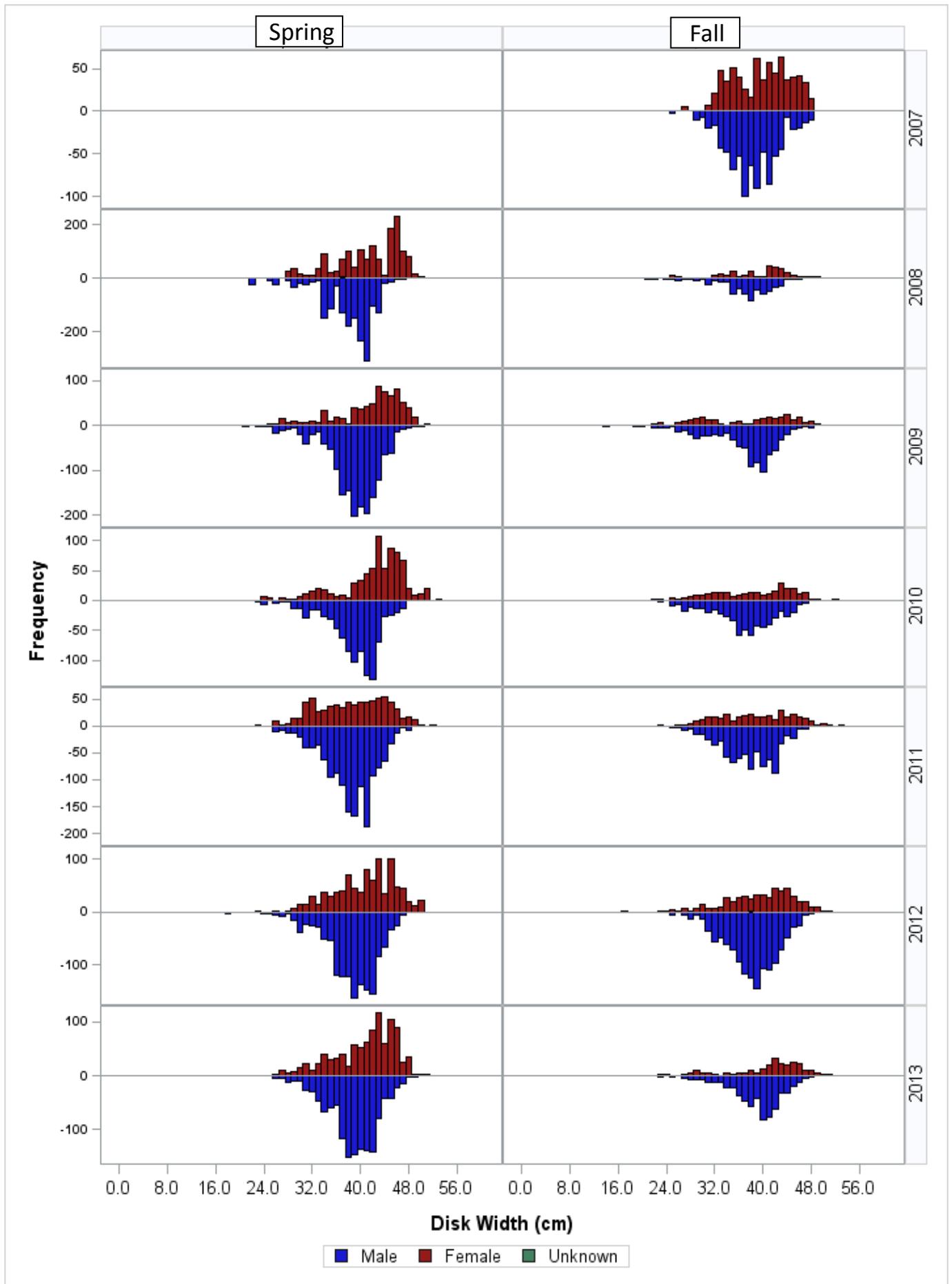


Figure 99. Clearnose Skate sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

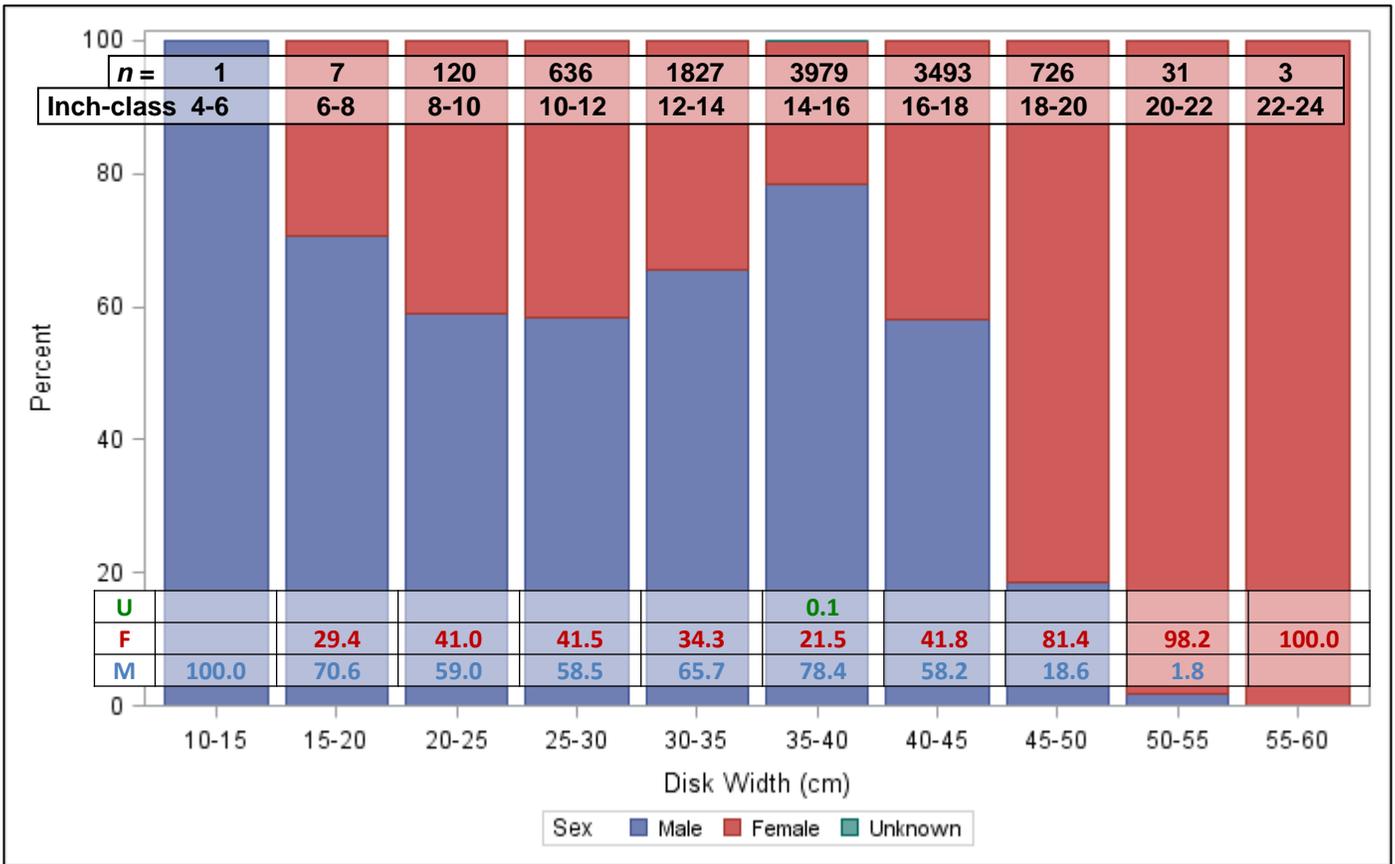


Figure 100. Clearnose Skate maturity at length, by sex for all cruises pooled, 2007-2013.

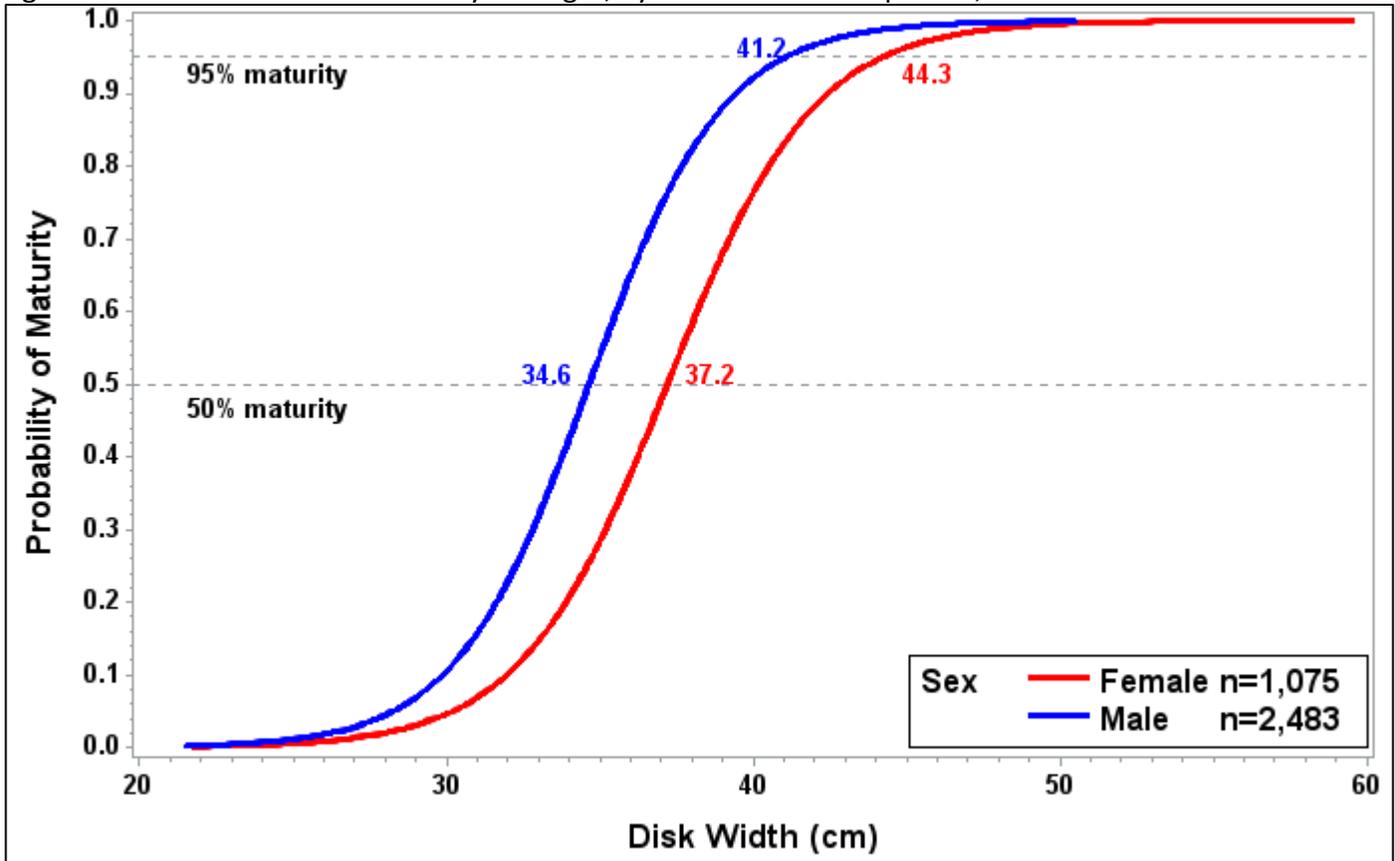
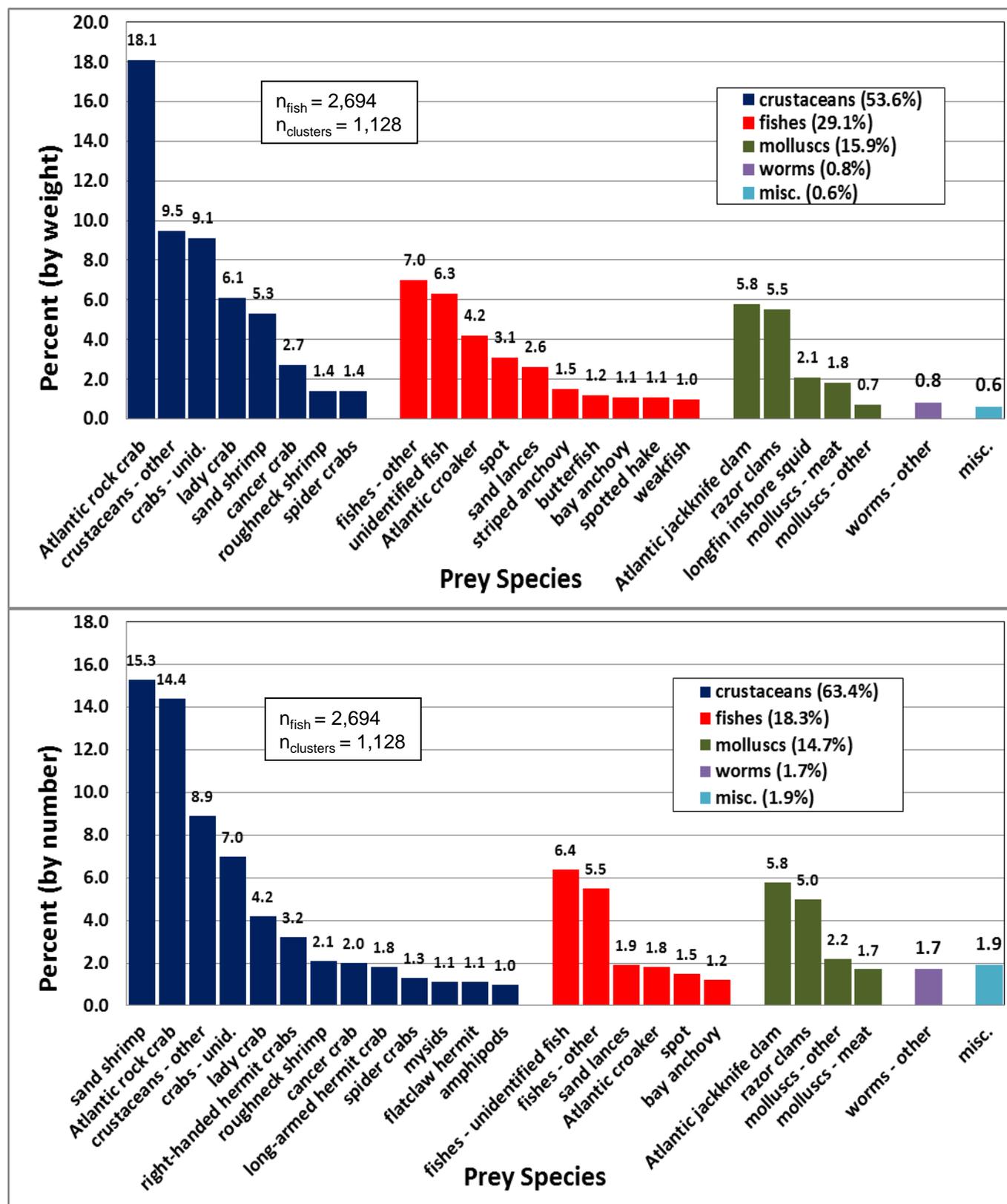


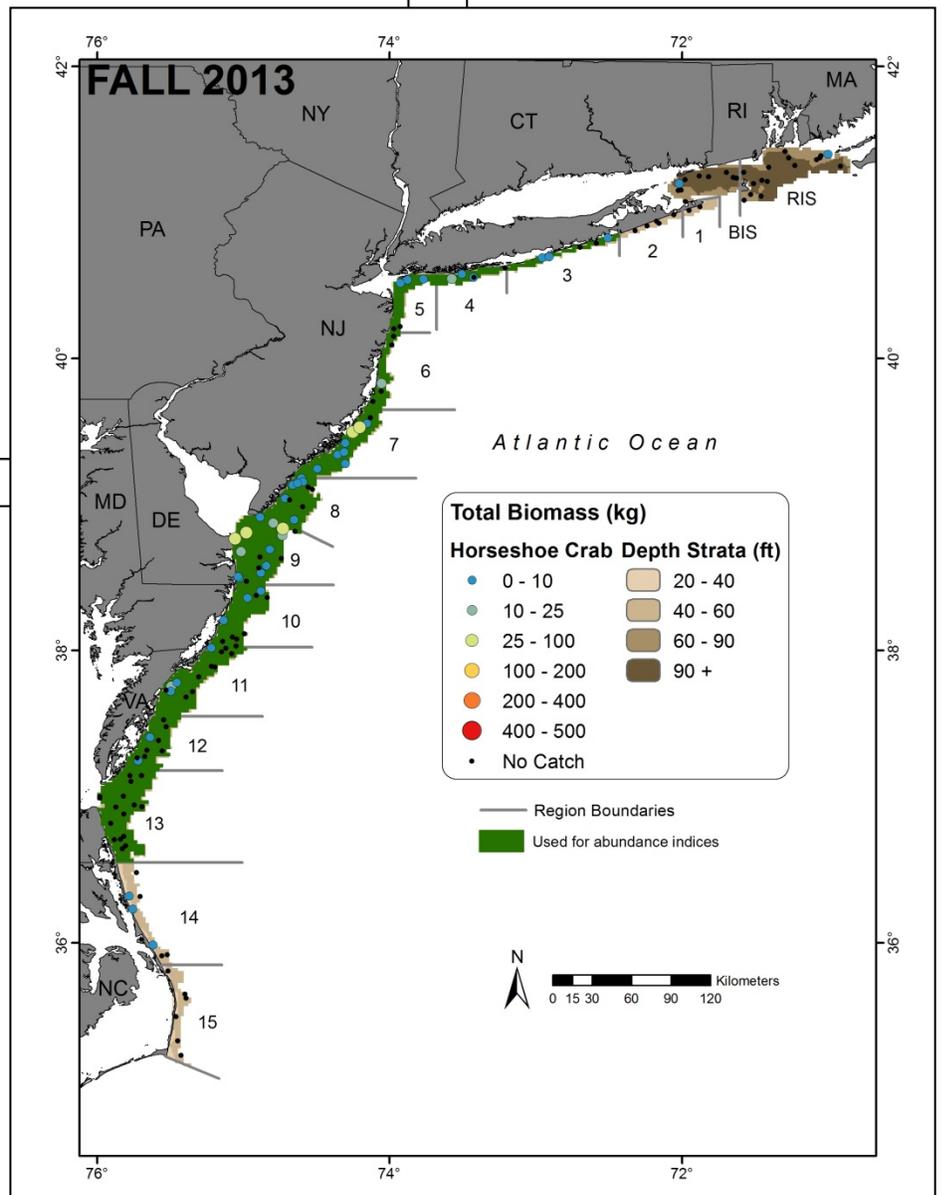
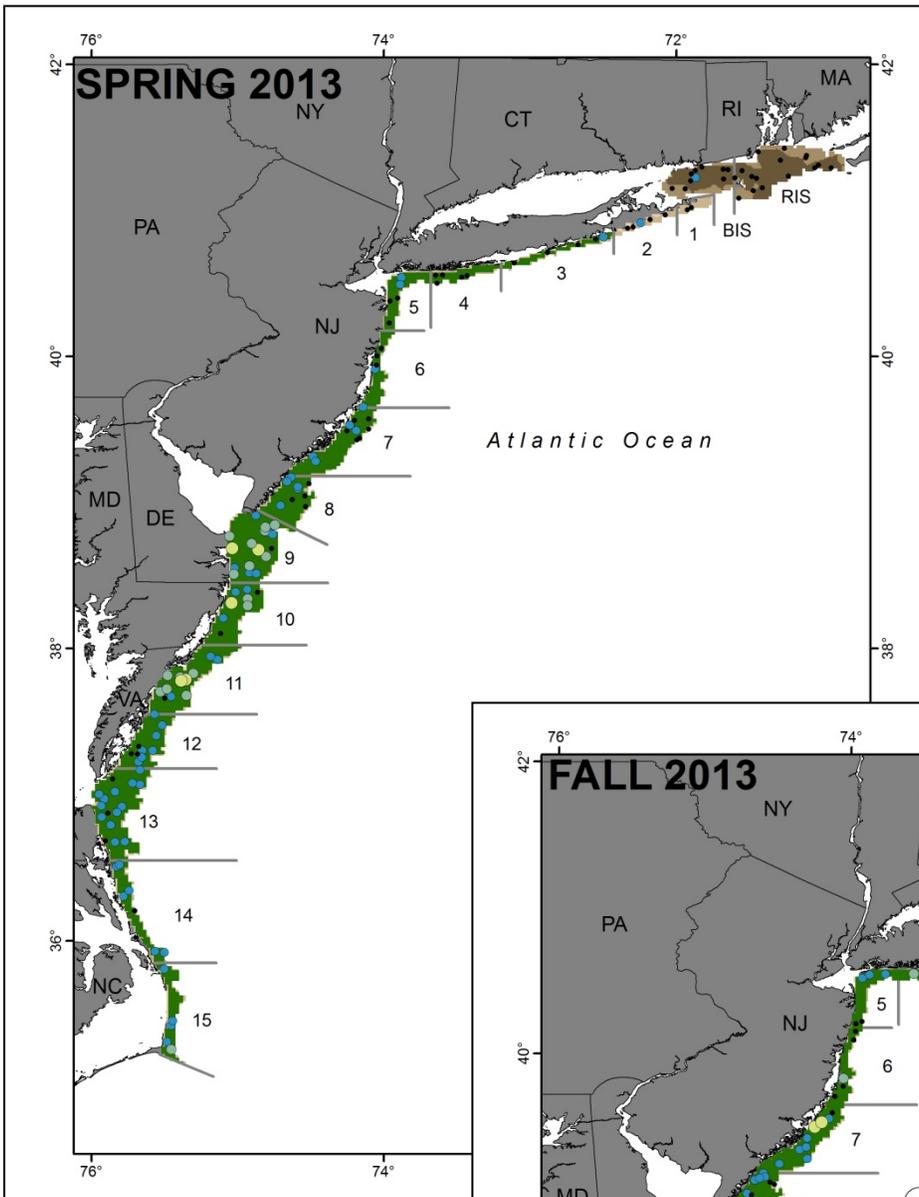
Figure 101. Clearnose Skate diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Horseshoe Crab

Sampling Priority: E

Figure 102. Horseshoe Crab biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	60-90		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
MD	10	20-40		
VA	11	20-40		
	11	40-60		
	12	20-40		
	12	40-60		
NC	13	20-40		
	13	40-60		
	14	20-40		
NC	15	20-40		
	15	40-60		
	15	20-40		

= used for abundance indices
 = not used for abundance indices

Table 36. Horseshoe Crab sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,201	1,229.6	774	N/A	N/A	N/A	N/A
	2009	2,388	2,703.5	1,673	N/A	N/A	N/A	N/A
	2010	1,432	1,220.7	979	N/A	N/A	N/A	N/A
	2011	1,747	1,625.1	1,559	N/A	N/A	N/A	N/A
	2012	723	785.5	500	N/A	N/A	N/A	N/A
	2013	933	734.0	933	N/A	N/A	N/A	N/A
Fall	2007	795	1,450.3	342	N/A	N/A	N/A	N/A
	2008	1,149	1,840.2	473	N/A	N/A	N/A	N/A
	2009	1,931	2,168.0	1,092	N/A	N/A	N/A	N/A
	2010	613	862.2	498	N/A	N/A	N/A	N/A
	2011	1,144	1,613.9	1,070	N/A	N/A	N/A	N/A
	2012	1,331	1,698.8	1,271	N/A	N/A	N/A	N/A
	2013	298	489.2	298	N/A	N/A	N/A	N/A

Table 37. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	104	0.83	1.24	1.75	1.10	1.69	2.43
	2008	116	2.79	3.59	4.55	3.05	3.92	4.97		2008	104	1.43	2.15	3.08	1.92	2.91	4.24
	2009	125	5.64	6.88	8.34	6.59	8.03	9.75		2009	110	1.87	2.79	4.00	2.07	3.11	4.50
	2010	117	2.48	3.21	4.08	2.26	2.90	3.66		2010	104	1.59	2.07	2.63	2.07	2.70	3.46
	2011	117	3.95	4.80	5.81	4.10	4.96	5.97		2011	104	2.01	2.78	3.74	2.64	3.67	5.01
	2012	117	0.90	1.28	1.73	1.02	1.43	1.92		2012	104	1.95	2.76	3.81	2.40	3.46	4.83
	2013	117	2.58	3.29	4.15	2.18	2.80	3.54		2013	104	0.72	1.01	1.35	0.95	1.35	1.84
	2014									2014							
	2015									2015							
	2016									2016							
Female	2007								Female	2007	104	0.63	0.96	1.36	0.94	1.46	2.12
	2008	116	2.03	2.64	3.37	2.44	3.18	4.08		2008	104	0.91	1.40	2.01	1.36	2.13	3.16
	2009	125	3.83	4.73	5.80	5.10	6.30	7.74		2009	110	1.30	1.93	2.72	1.62	2.43	3.48
	2010	117	1.82	2.34	2.95	1.88	2.41	3.03		2010	104	0.93	1.23	1.58	1.47	1.94	2.51
	2011	117	2.63	3.19	3.84	3.09	3.77	4.55		2011	104	1.23	1.70	2.27	1.92	2.71	3.71
	2012	117	0.67	0.97	1.33	0.84	1.20	1.62		2012	104	1.19	1.72	2.37	1.77	2.60	3.67
	2013	117	1.76	2.26	2.86	1.65	2.15	2.75		2013	104	0.46	0.67	0.90	0.74	1.08	1.49
	2014									2014							
	2015									2015							
	2016									2016							
Male	2007								Male	2007	104	0.41	0.62	0.87	0.42	0.65	0.90
	2008	116	0.67	0.89	1.13	0.67	0.89	1.14		2008	104	0.61	0.95	1.36	0.62	0.97	1.39
	2009	125	1.84	2.22	2.65	1.75	2.12	2.54		2009	110	0.89	1.38	2.00	0.86	1.34	1.95
	2010	117	1.06	1.43	1.85	0.75	1.01	1.30		2010	104	0.89	1.16	1.46	0.86	1.11	1.41
	2011	117	1.63	2.06	2.57	1.24	1.57	1.95		2011	104	1.14	1.63	2.22	1.16	1.65	2.25
	2012	117	0.40	0.59	0.81	0.33	0.50	0.68		2012	104	1.14	1.64	2.25	1.09	1.57	2.15
	2013	117	0.99	1.29	1.64	0.70	0.91	1.14		2013	104	0.38	0.55	0.74	0.36	0.52	0.71
	2014									2014							
	2015									2015							
	2016									2016							

Figure 103. Horseshoe Crab geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by sex.

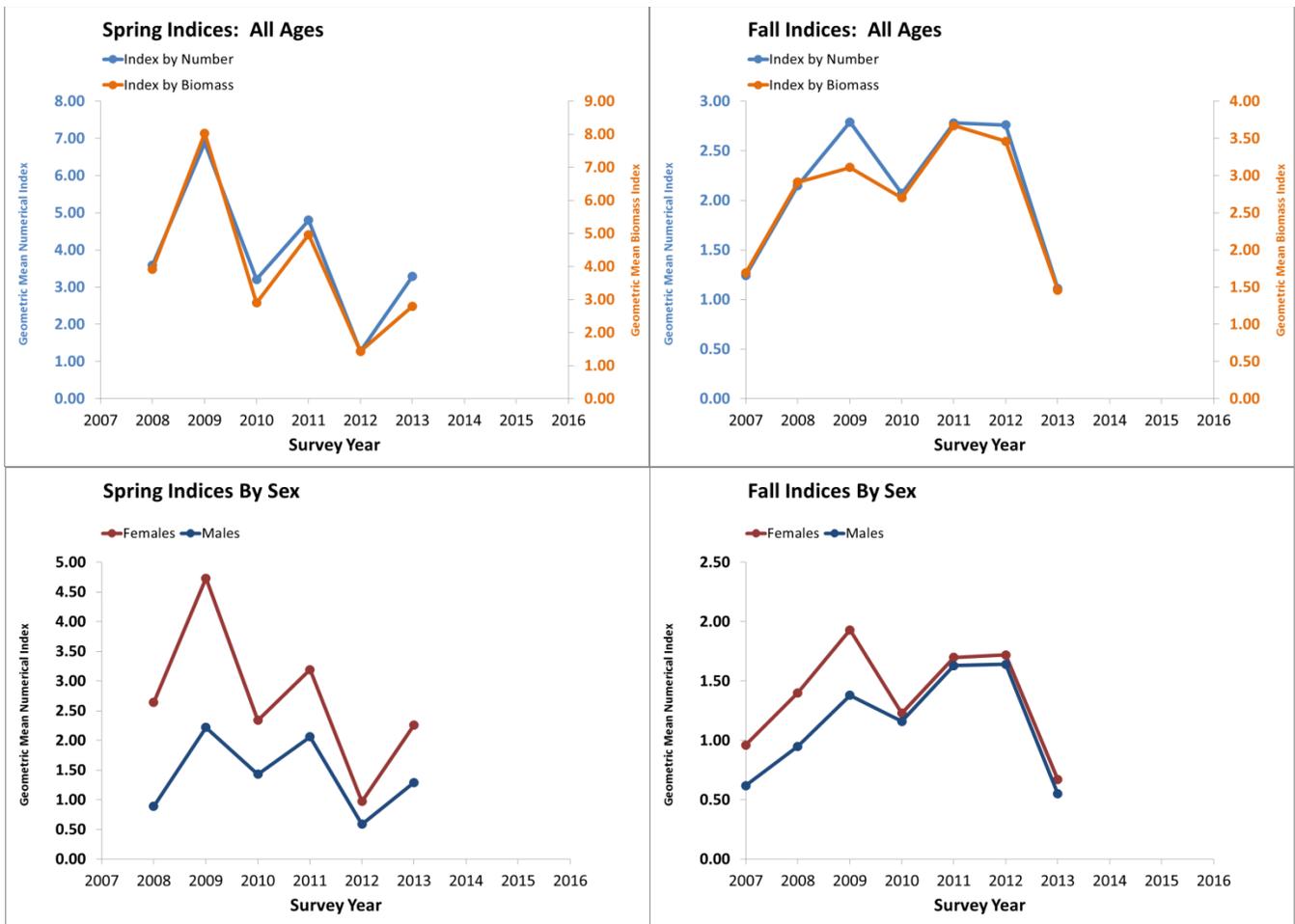


Figure 104. Horseshoe Crab width-frequency distributions, by cruise.

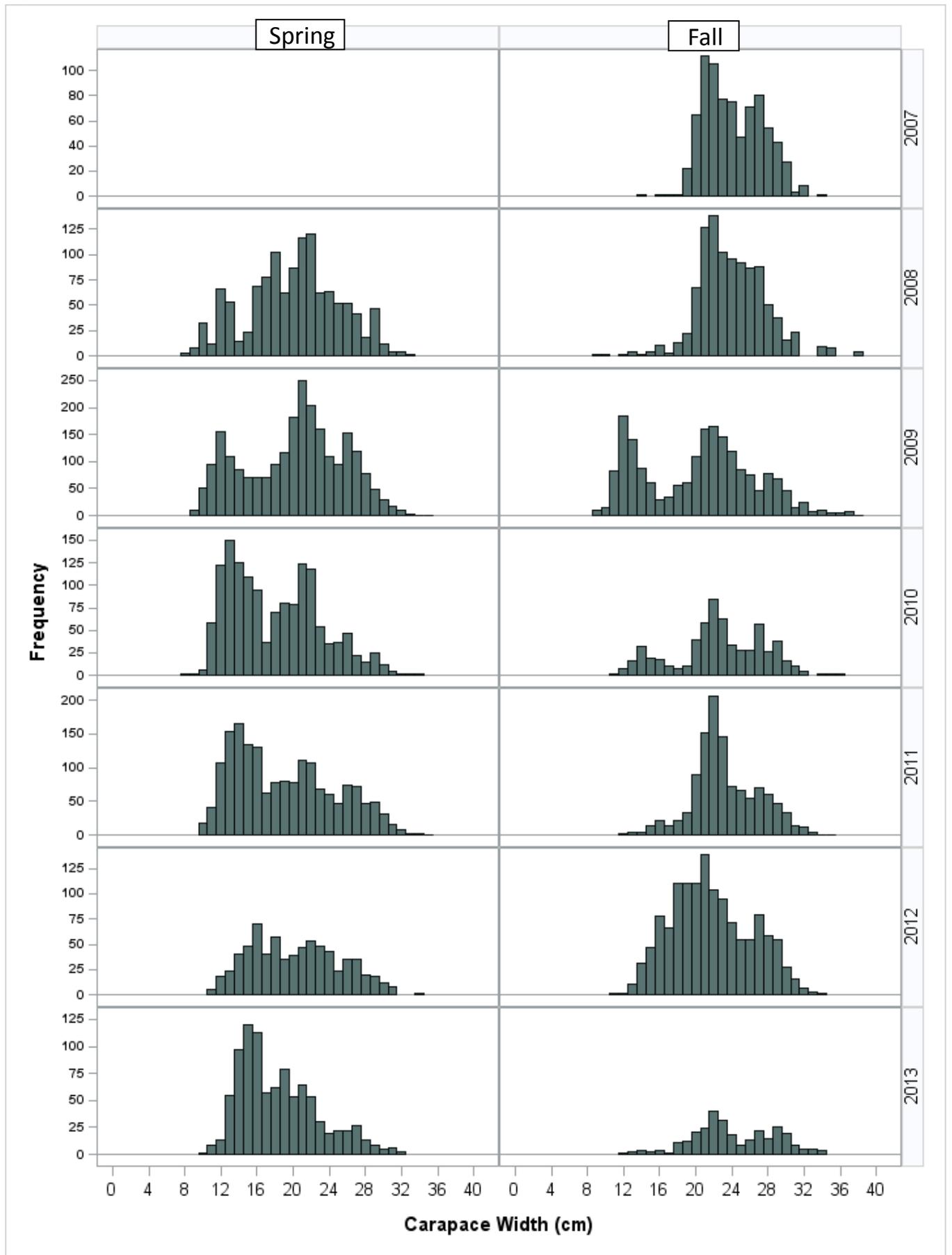


Figure 105. Horseshoe Crab width-frequency distributions, by cruise and sex.

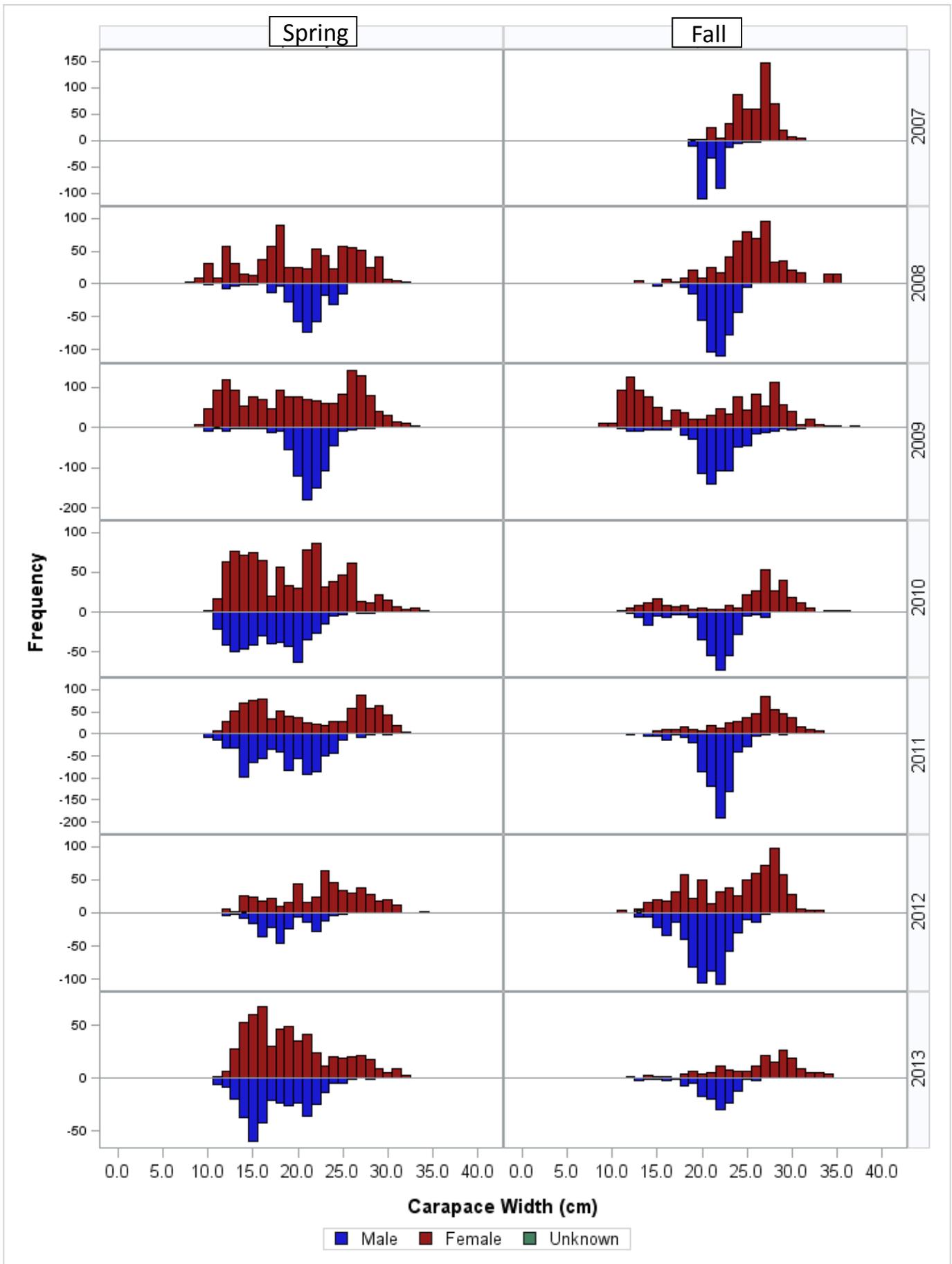


Figure 106. Horseshoe Crab sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

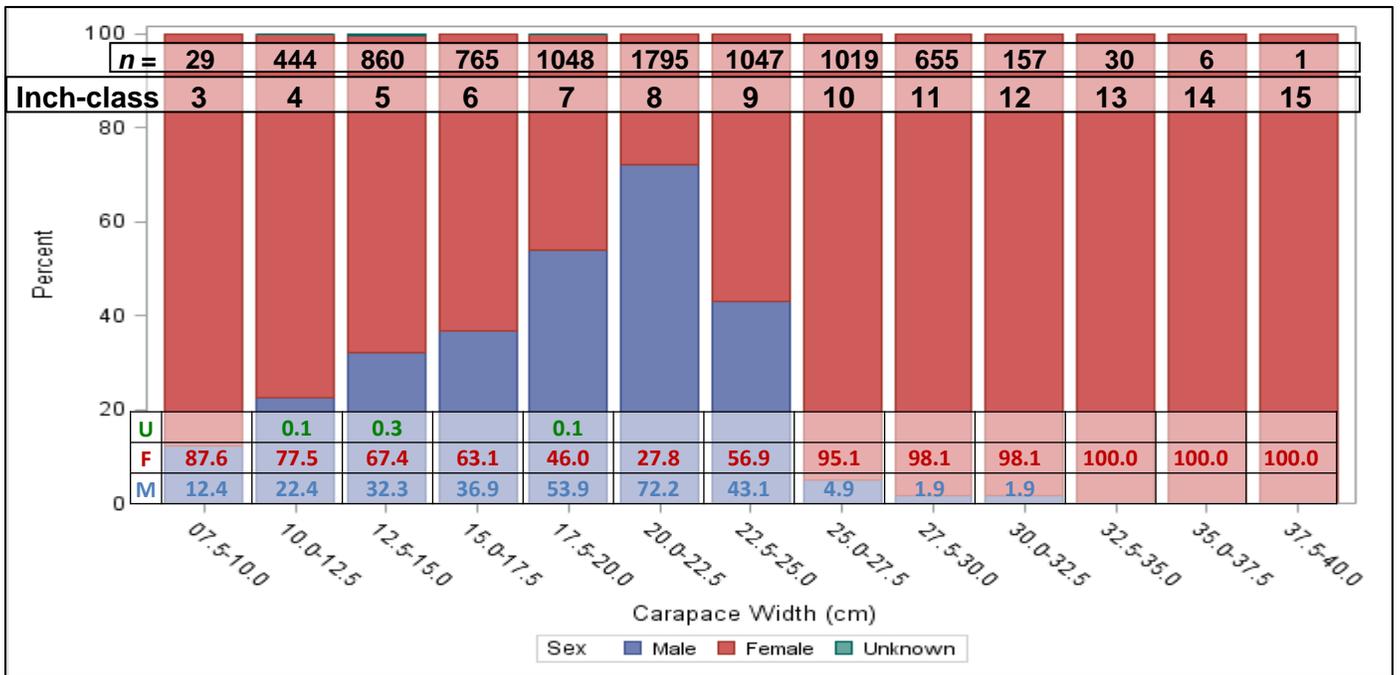


Figure 107. Horseshoe Crab maturity at length, by sex for all cruises pooled, 2007-2013.

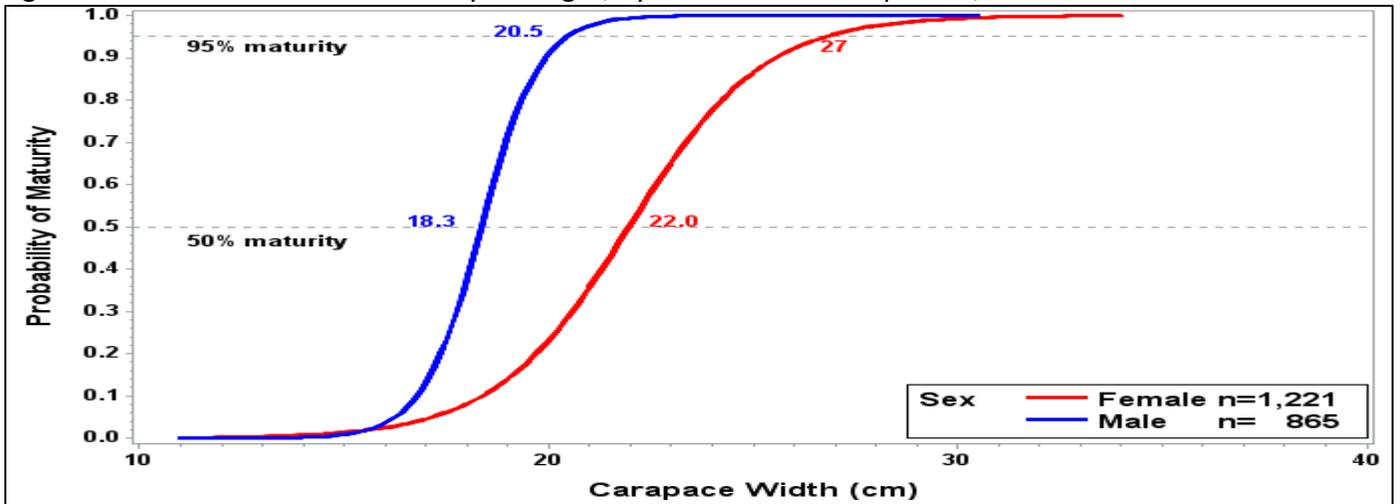
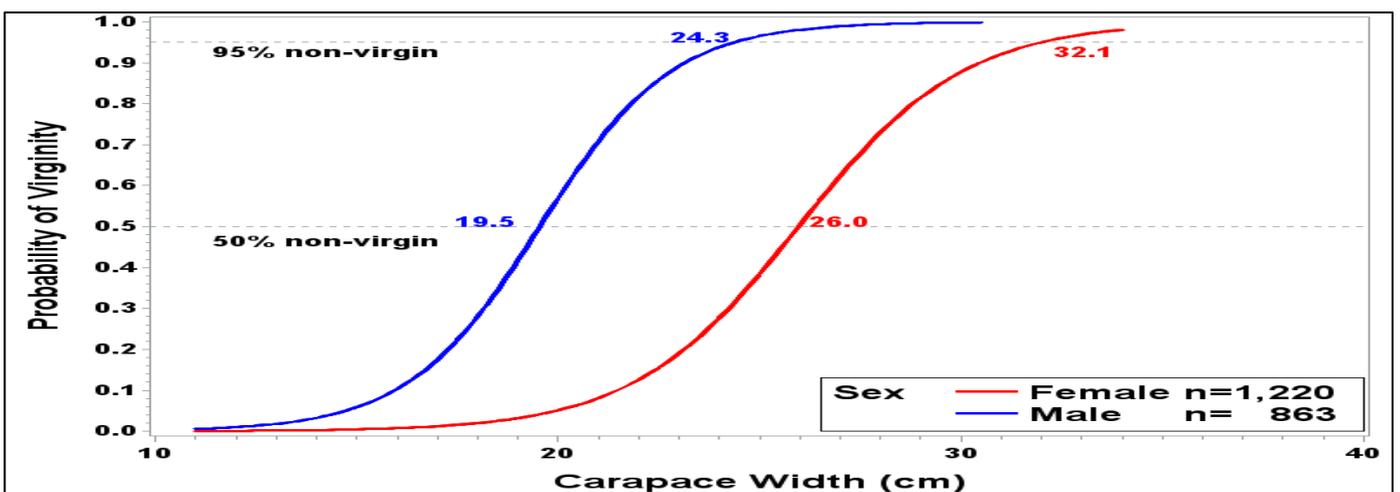


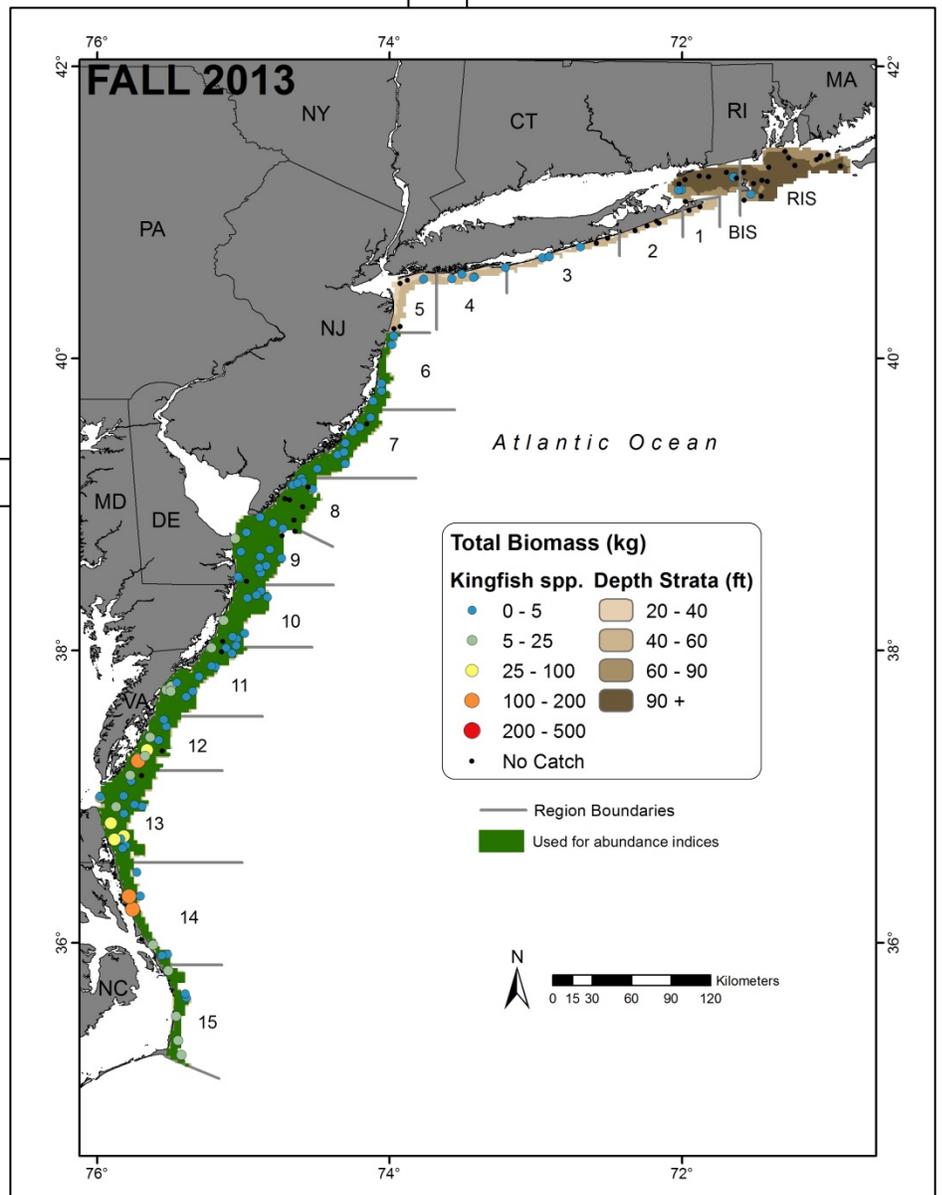
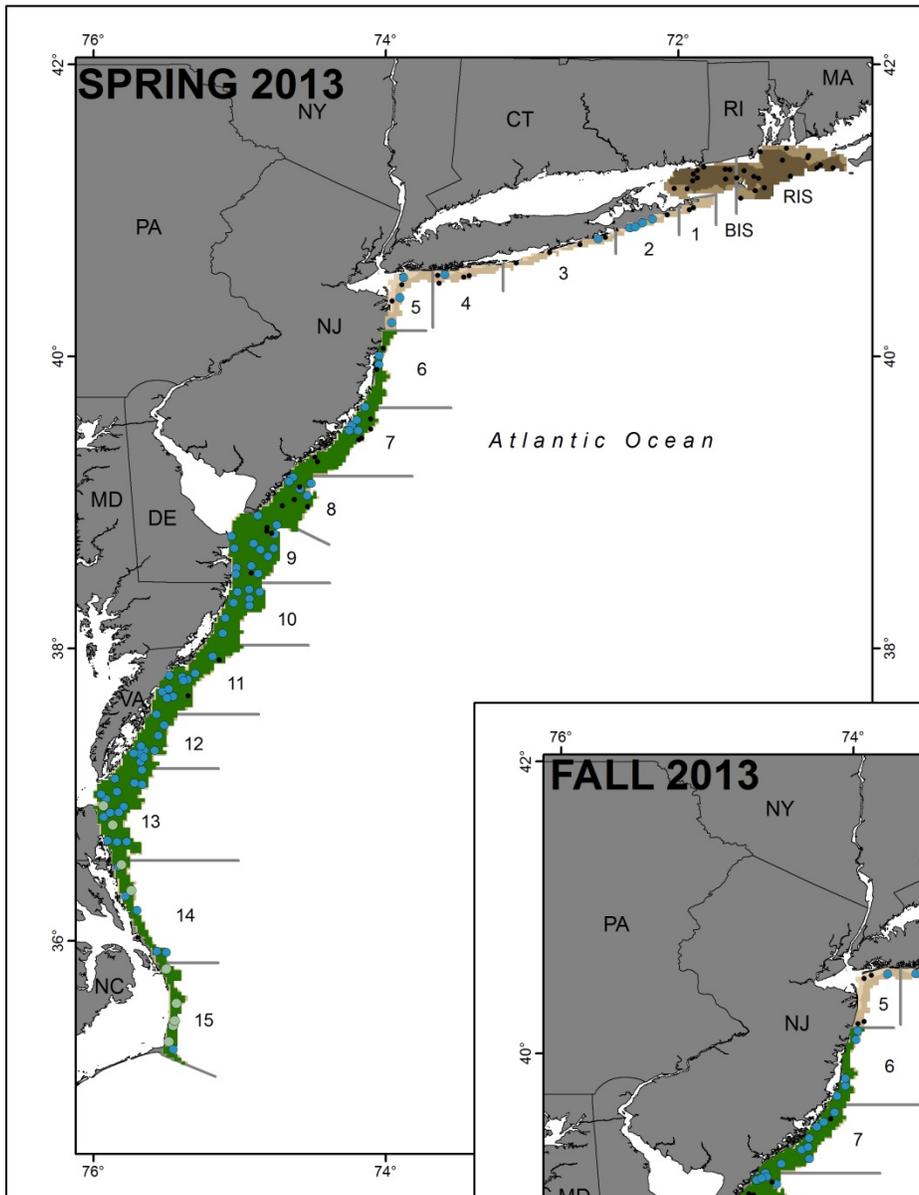
Figure 108. Horseshoe Crab virginity at length, by sex for all cruises pooled, 2007-2013.



Kingfish

Sampling Priority: A (as of 2012)

Figure 109. Kingfish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 38. Kingfish sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	6,638	699.8	759	0	0	0	0
	2009	1,742	207.8	483	0	0	0	0
	2010	13,179	1,230.9	479	0	0	0	0
	2011	2,098	147.2	1,216	0	0	0	0
	2012	3,435	365.2	2,101	93	0	77	0
	2013	2,309	189.1	1,927	75	0	70	0
Fall	2007	9,124	1,398.8	1,707	0	0	0	0
	2008	8,026	1,254.4	1,502	0	0	0	0
	2009	7,969	888.9	3,303	0	0	0	0
	2010	18,979	2,479.4	1,925	0	0	0	0
	2011	10,644	1,398.8	3,245	0	0	0	0
	2012	11,291	1,333.5	4,733	181	0	139	0
	2013	6,805	958.8	2,458	101	0	73	0

Table 39. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	102	4.59	6.78	9.85	1.29	1.87	2.59
	2008	101	2.67	3.75	5.15	0.74	1.08	1.48	2008	102	6.69	9.59	13.59	2.18	2.99	4.01	
	2009	107	0.67	0.94	1.26	0.21	0.30	0.40	2009	107	11.30	14.82	19.35	2.34	2.95	3.67	
	2010	102	0.34	0.69	1.13	0.07	0.28	0.53	2010	102	6.27	9.00	12.76	1.64	2.34	3.21	
	2011	102	1.31	1.89	2.62	0.36	0.52	0.71	2011	102	13.29	18.38	25.28	2.92	3.86	5.03	
	2012	102	4.92	6.57	8.67	1.05	1.37	1.74	2012	102	14.21	19.32	26.15	2.91	3.80	4.90	
	2013	103	3.97	4.99	6.21	0.81	1.00	1.20	2013	103	5.48	7.63	10.50	1.45	1.98	2.63	
	2014								2014								
0	2007							0	2007	102	1.91	2.82	4.03	0.50	0.78	1.11	
2008	101	0.41	0.69	1.03	0.10	0.23	0.38	2008	102	2.15	3.17	4.53	0.73	1.06	1.45		
2009	107	0.12	0.29	0.48	0.03	0.10	0.17	2009	107	5.68	7.69	10.29	1.19	1.55	1.98		
2010	102	0.04	0.28	0.58	0.00	0.13	0.31	2010	102	3.11	4.58	6.58	0.85	1.27	1.79		
2011	102	0.29	0.61	1.03	0.08	0.18	0.29	2011	102	4.89	6.85	9.47	1.18	1.60	2.12		
2012	102	0.73	1.06	1.45	0.18	0.28	0.39	2012	102	6.04	8.16	10.90	1.24	1.65	2.12		
2013	103	0.85	1.16	1.52	0.21	0.29	0.38	2013	103	1.64	2.34	3.22	0.48	0.68	0.91		
2014								2014									
2015								2015									
2016								2016									
1	2007							1	2007	102	2.32	3.41	4.86	0.69	1.02	1.42	
2008	101	0.54	0.87	1.27	0.12	0.28	0.46	2008	102	3.33	4.74	6.61	1.12	1.55	2.07		
2009	107	0.18	0.32	0.47	0.06	0.09	0.13	2009	107	3.58	4.52	5.67	0.80	1.02	1.27		
2010	102	0.06	0.29	0.58	0.00	0.13	0.31	2010	102	2.42	3.53	5.00	0.71	1.07	1.51		
2011	102	0.28	0.51	0.79	0.06	0.14	0.23	2011	102	6.12	8.30	11.14	1.38	1.84	2.39		
2012	102	1.25	1.67	2.16	0.27	0.38	0.51	2012	102	5.80	7.84	10.49	1.33	1.74	2.23		
2013	103	0.93	1.20	1.50	0.17	0.23	0.30	2013	103	2.43	3.45	4.77	0.71	1.01	1.35		
2014								2014									
2015								2015									
2016								2016									
2	2007							2	2007	102	1.30	1.88	2.61	0.40	0.60	0.83	
2008	101	1.32	1.93	2.70	0.34	0.56	0.82	2008	102	2.00	2.75	3.68	0.65	0.88	1.15		
2009	107	0.39	0.55	0.71	0.11	0.16	0.20	2009	107	1.97	2.54	3.22	0.45	0.60	0.77		
2010	102	0.16	0.42	0.75	0.00	0.17	0.36	2010	102	1.31	1.86	2.54	0.39	0.57	0.78		
2011	102	0.68	0.95	1.26	0.16	0.25	0.34	2011	102	2.54	3.38	4.41	0.60	0.82	1.06		
2012	102	2.71	3.55	4.59	0.54	0.73	0.95	2012	102	2.32	3.10	4.06	0.56	0.74	0.94		
2013	103	1.86	2.31	2.84	0.34	0.43	0.53	2013	103	1.57	2.13	2.83	0.42	0.59	0.77		
2014								2014									
2015								2015									
2016								2016									
3+	2007							3+	2007	102	0.78	1.16	1.61	0.25	0.39	0.55	
2008	101	1.01	1.47	2.05	0.27	0.44	0.64	2008	102	1.32	1.83	2.44	0.44	0.60	0.77		
2009	107	0.29	0.39	0.50	0.07	0.10	0.13	2009	107	1.26	1.63	2.07	0.28	0.38	0.49		
2010	102	0.12	0.35	0.61	0.01	0.13	0.27	2010	102	0.95	1.31	1.75	0.28	0.40	0.53		
2011	102	0.51	0.68	0.88	0.11	0.16	0.21	2011	102	1.32	1.75	2.26	0.32	0.44	0.58		
2012	102	1.29	1.70	2.19	0.24	0.35	0.47	2012	102	1.26	1.70	2.22	0.31	0.43	0.56		
2013	103	0.92	1.15	1.42	0.16	0.21	0.26	2013	103	1.03	1.38	1.79	0.27	0.38	0.49		
2014								2014									
2015								2015									
2016								2016									

Figure 110. Kingfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and by age class (B).

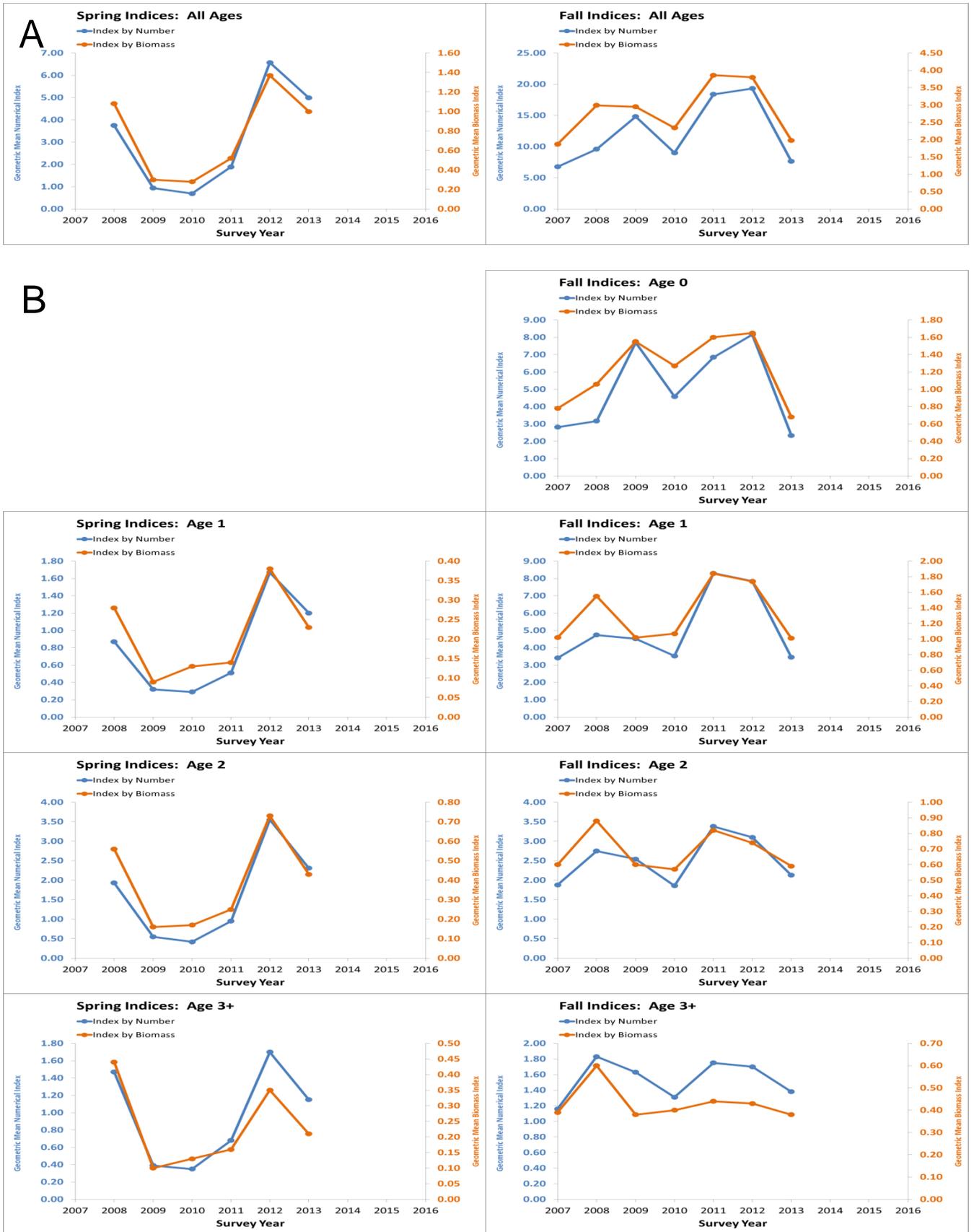


Figure 111. Kingfish length-frequency distributions, by cruise.

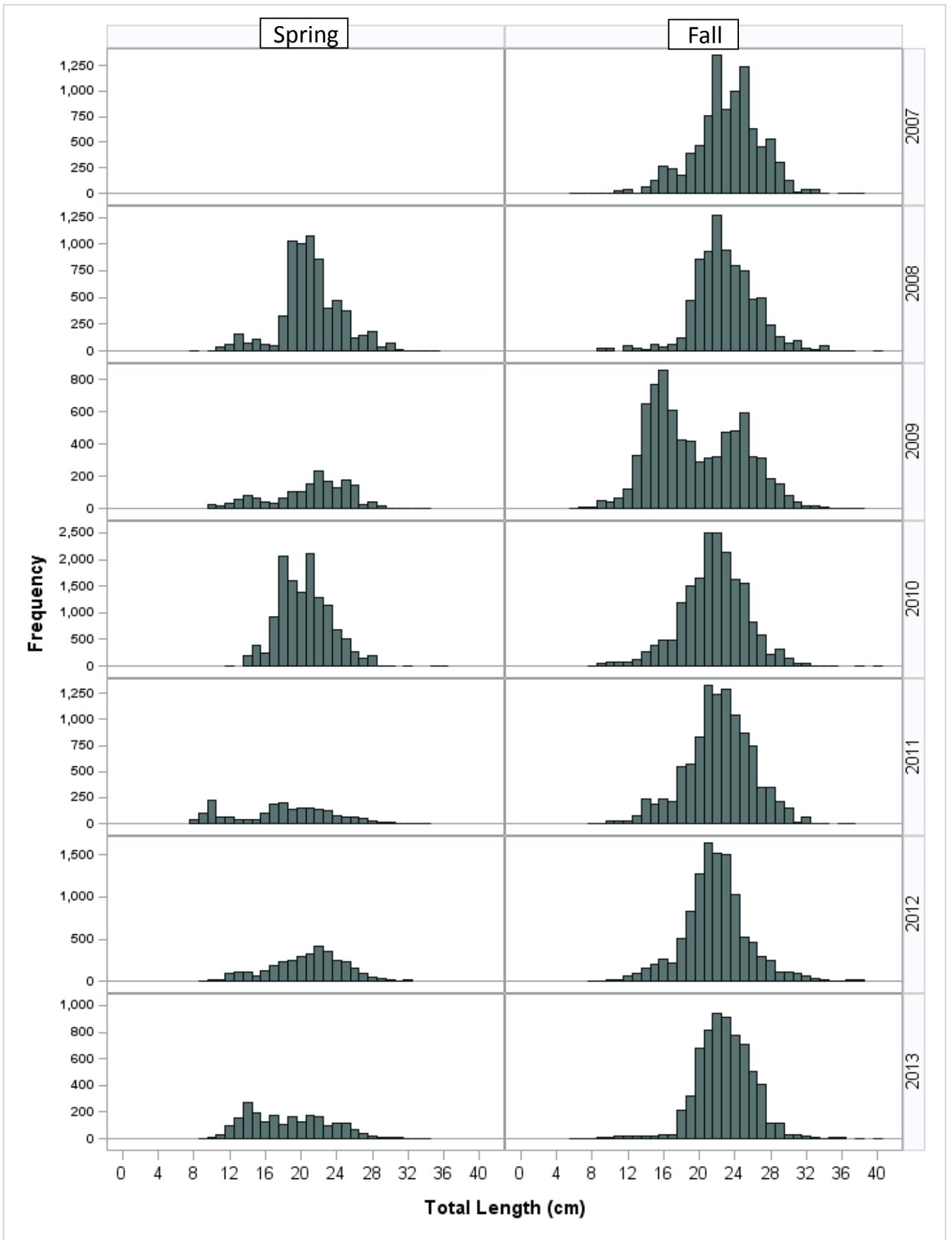


Figure 112. Kingfish sex ratio, by length group, for all cruises pooled, 2012-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

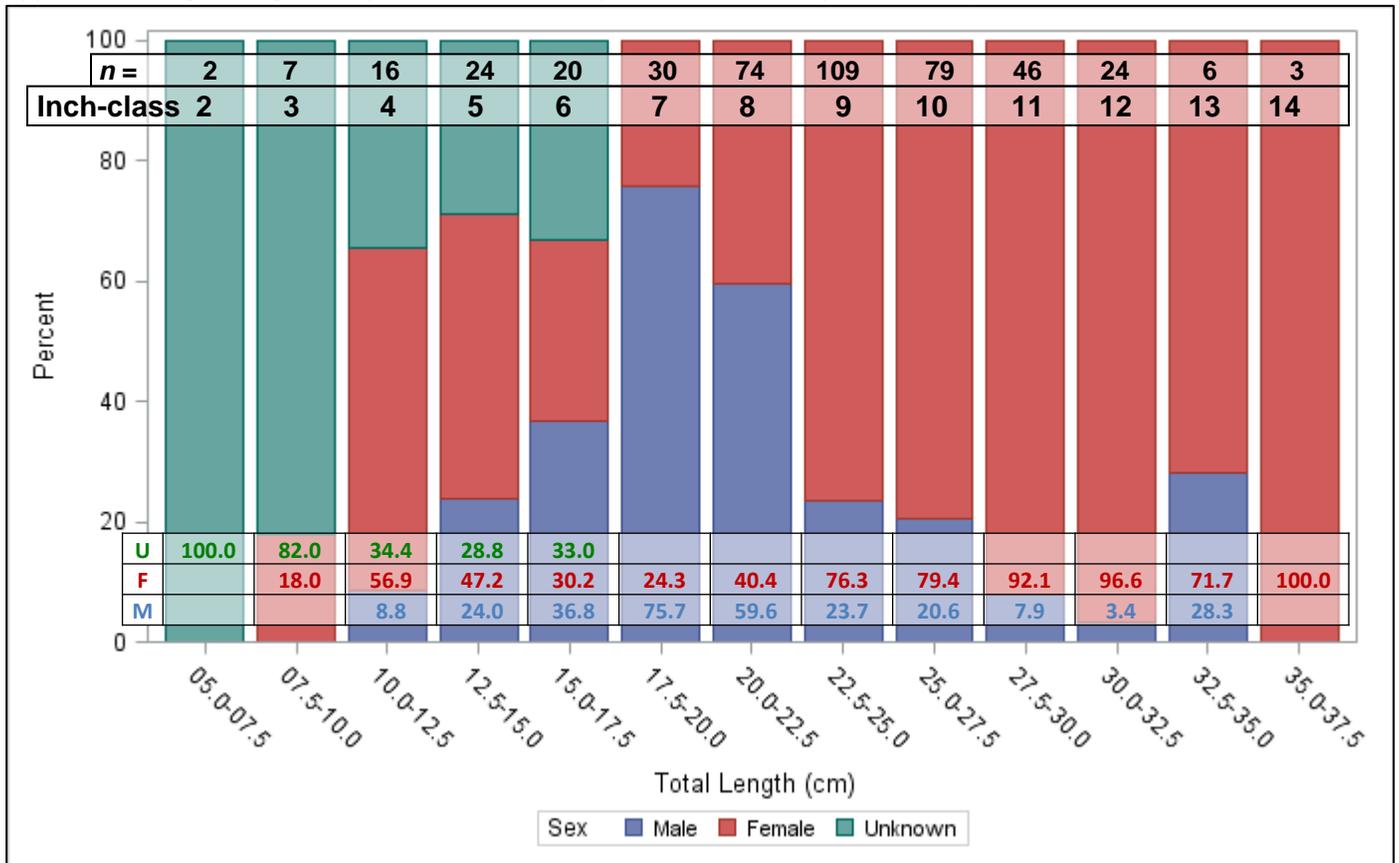
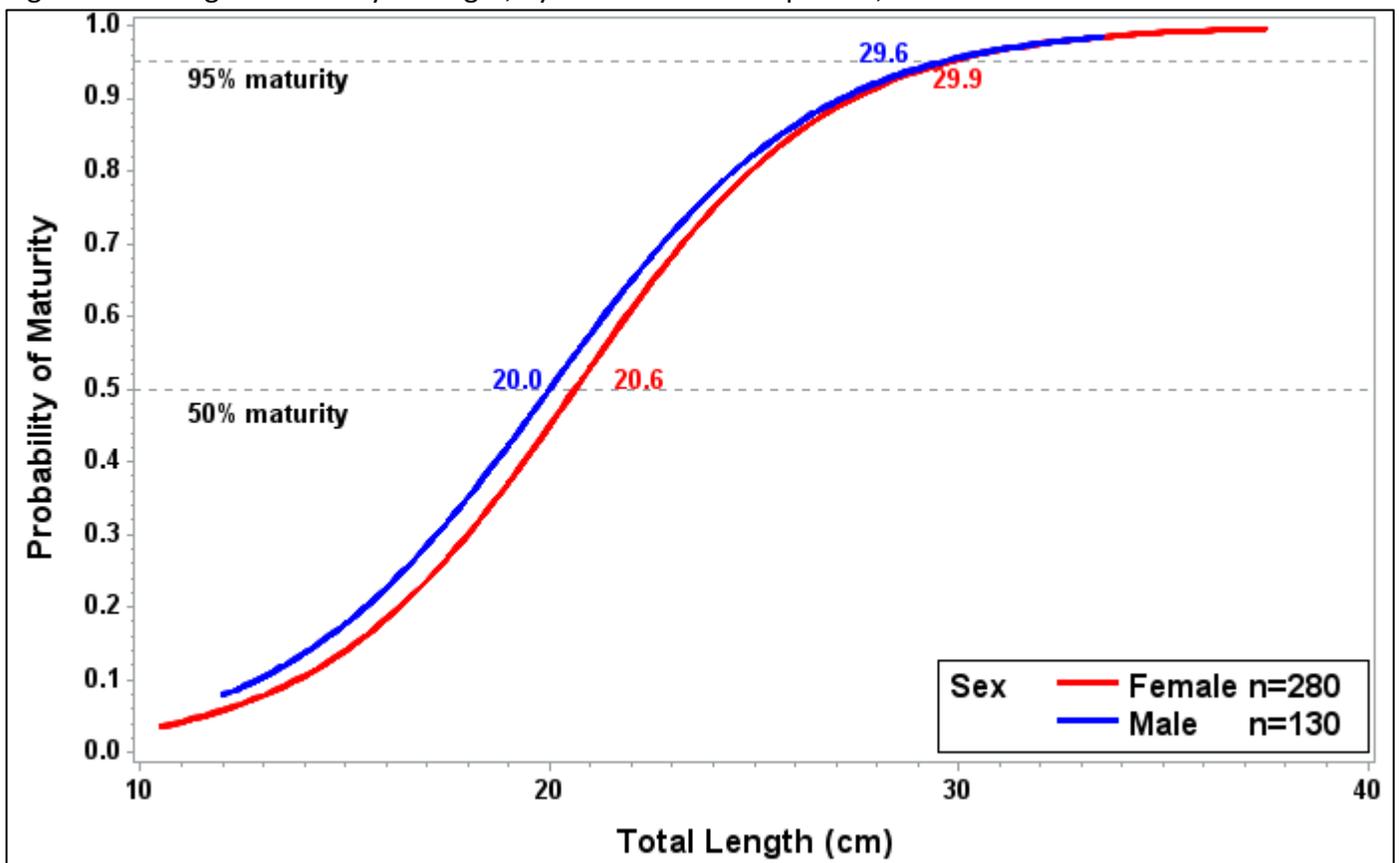


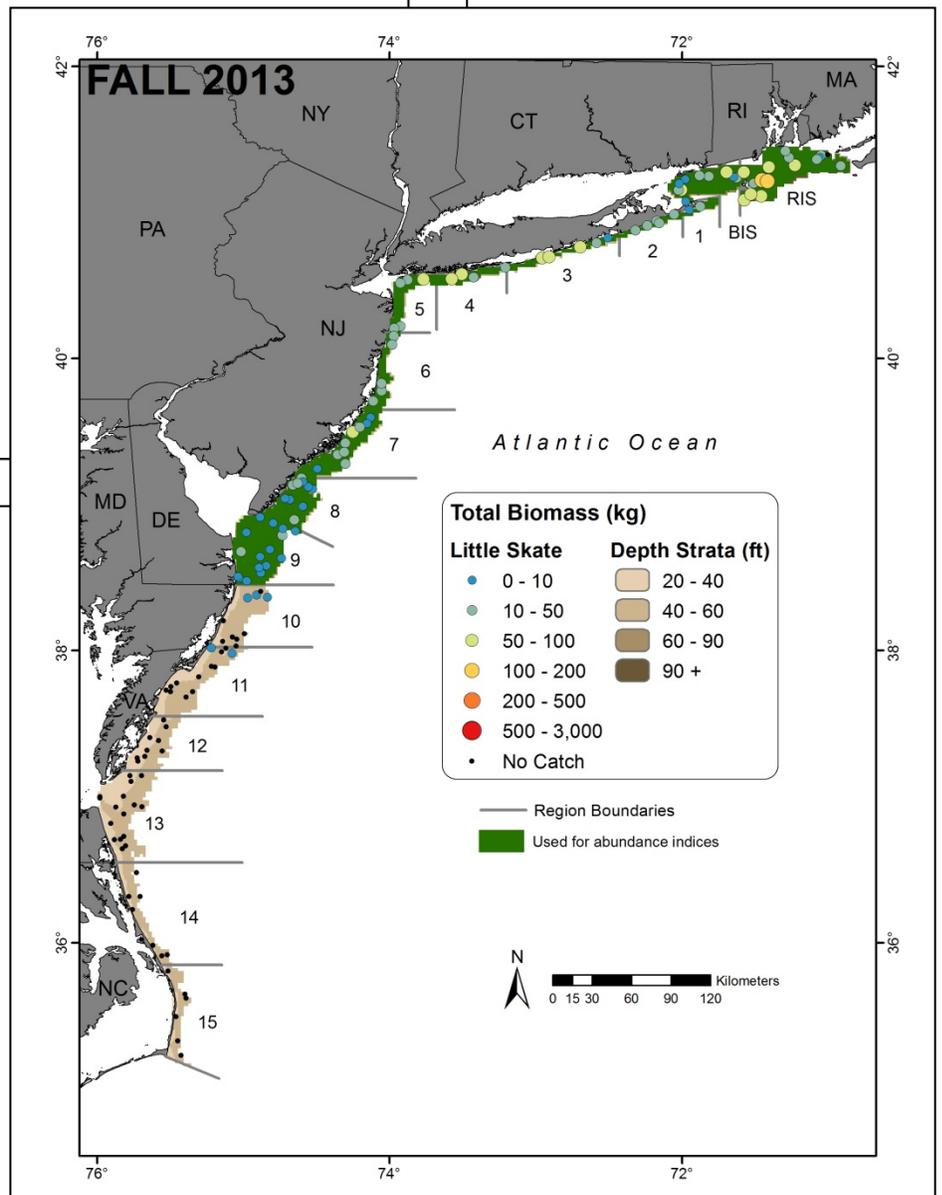
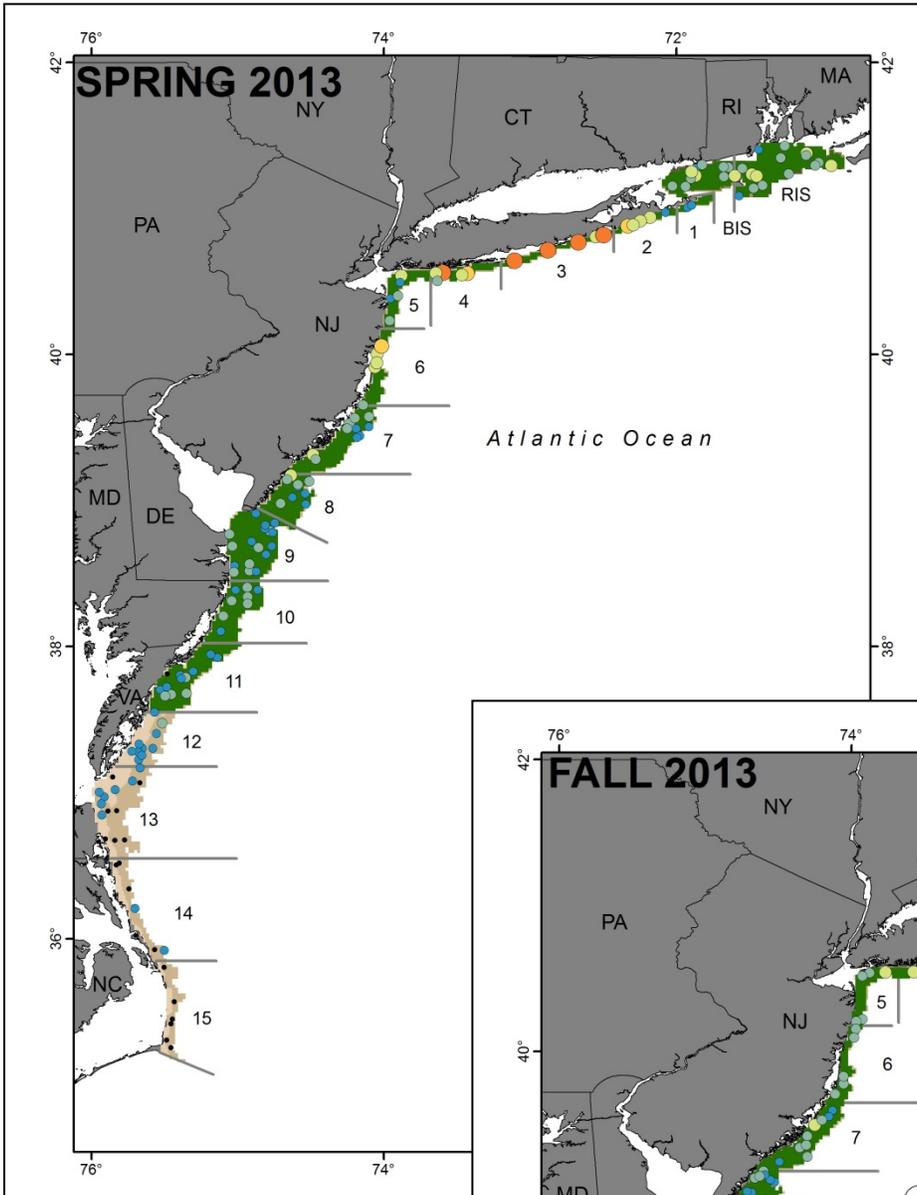
Figure 113. Kingfish maturity at length, by sex for all cruises pooled, 2012-2013.



Little Skate

Sampling Priority: A

Figure 114. Little Skate biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	■
	BIS	90+		
NY	01	40-60	■	■
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40	■	■
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40	■	■
	09	40-60		
	09	60-90		
MD	10	20-40	■	■
	10	40-60		
VA	11	20-40	■	■
	11	40-60		
	11	40-60		
NC	12	20-40	■	■
	12	40-60		
	12	40-60		
NC	13	20-40	■	■
	13	40-60		
	13	40-60		
NC	14	20-40	■	■
	14	40-60		
	14	40-60		
NC	15	20-40	■	■
	15	40-60		
	15	40-60		

■ = used for abundance indices
 ■ = not used for abundance indices

Table 40. Little Skate sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	9,873	5,862.5	2,991	312	0	301	300
	2009	23,391	12,464.9	5,115	397	0	383	382
	2010	7,802	4,262.2	3,330	337	0	328	318
	2011	7,800	4,323.0	4,880	322	0	291	287
	2012	11,091	5,862.7	5,293	312	0	273	265
	2013	10,991	5,232.1	5,532	371	0	313	304
Fall	2007	5,288	3,026.2	2,659	194	0	188	181
	2008	7,014	4,104.8	2,247	263	0	259	256
	2009	8,442	4,966.0	4,371	304	0	284	277
	2010	6,453	3,739.1	3,672	263	0	238	236
	2011	6,293	3,729.9	3,553	259	0	218	215
	2012	3,642	2,054.3	2,370	184	0	143	135
	2013	4,480	2,429.4	3,606	267	0	229	0

Table 41. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey								Fall Survey									
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007							All	2007	84	9.71	12.38	15.72	6.70	8.41	10.51	
	2008	109	33.27	39.73	47.41	20.88	24.84	29.51		2008	89	22.58	28.20	35.16	13.84	17.14	21.17
	2009	120	41.18	48.38	56.80	23.48	27.60	32.41		2009	96	32.79	37.85	43.67	19.42	22.28	25.53
	2010	112	24.74	29.05	34.09	14.56	17.11	20.07		2010	89	19.79	25.44	32.63	12.19	15.51	19.65
	2011	112	21.66	25.44	29.85	13.13	15.36	17.93		2011	89	19.61	23.32	27.69	12.13	14.38	17.02
	2012	112	21.67	25.26	29.41	12.96	15.02	17.39		2012	89	6.04	7.61	9.53	4.05	5.03	6.21
	2013	111	23.11	27.21	32.01	12.87	15.07	17.62		2013	89	23.12	29.23	36.89	13.19	16.54	20.70
	2014									2014							
	2015									2015							
	2016									2016							

Figure 115. Little Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

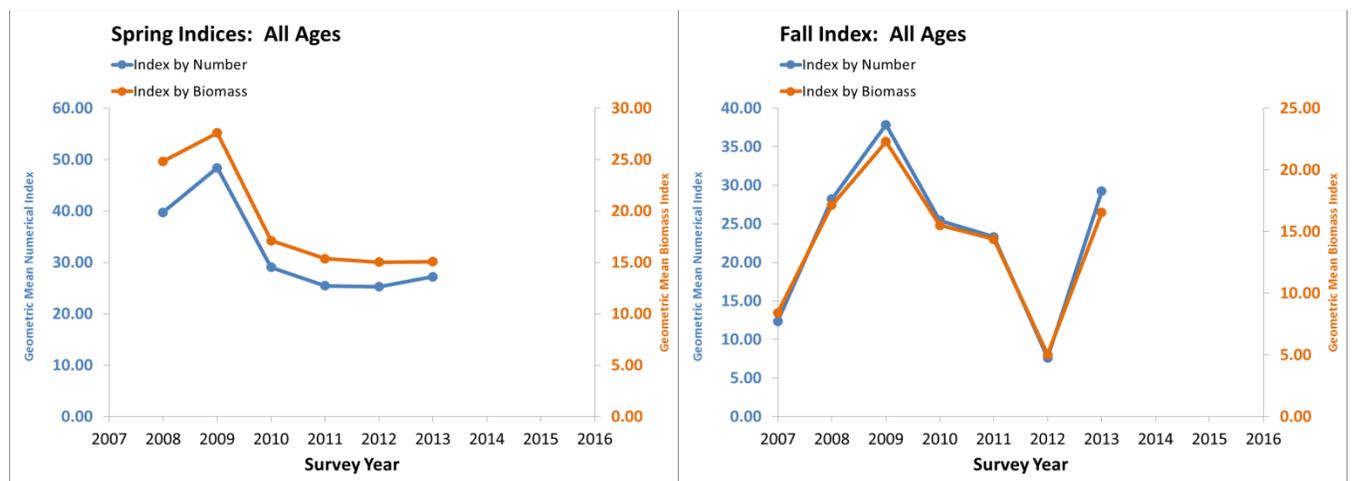


Figure 116. Little Skate width-frequency distributions, by cruise.

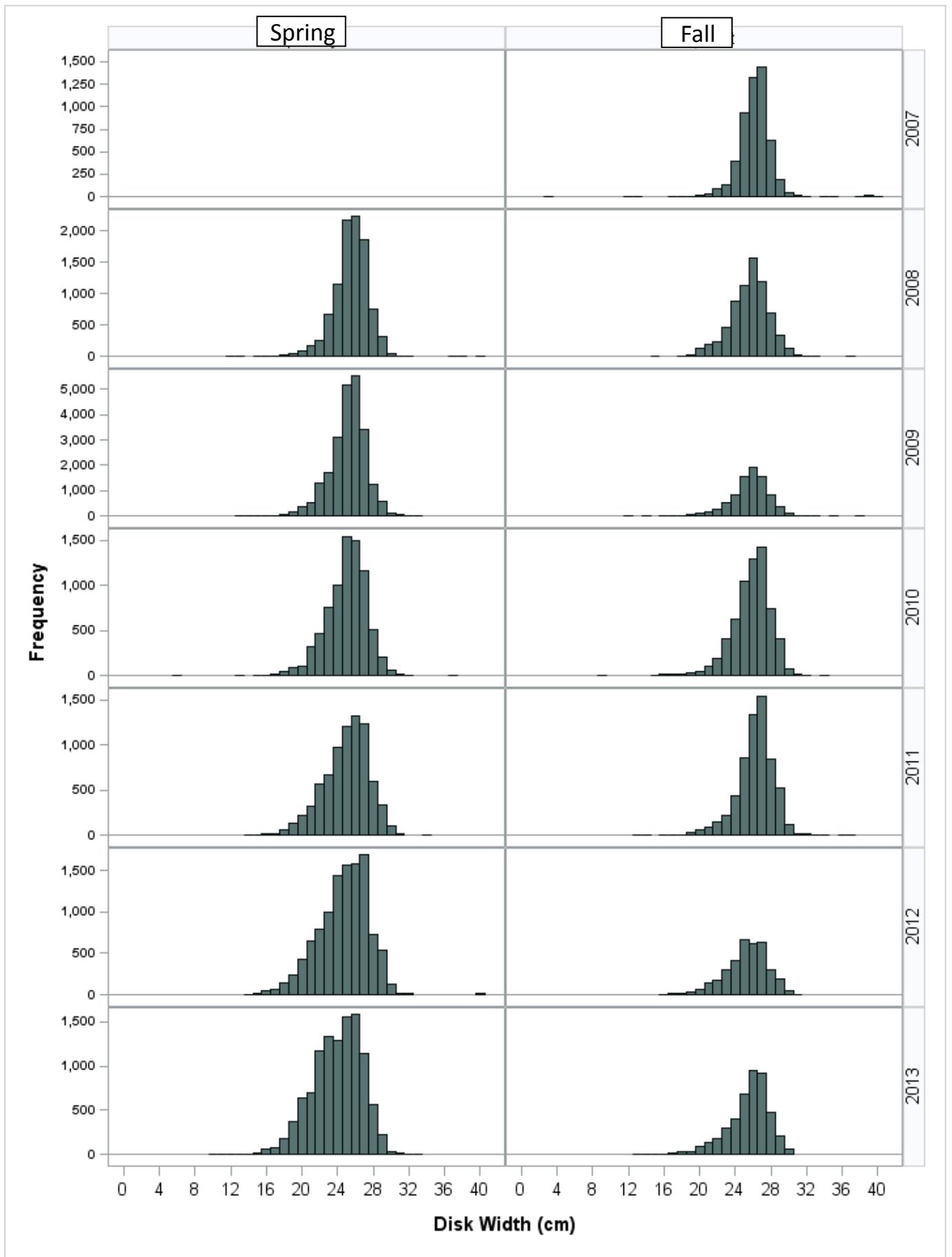


Figure 117. Little Skate width-frequency distributions, by cruise and sex.

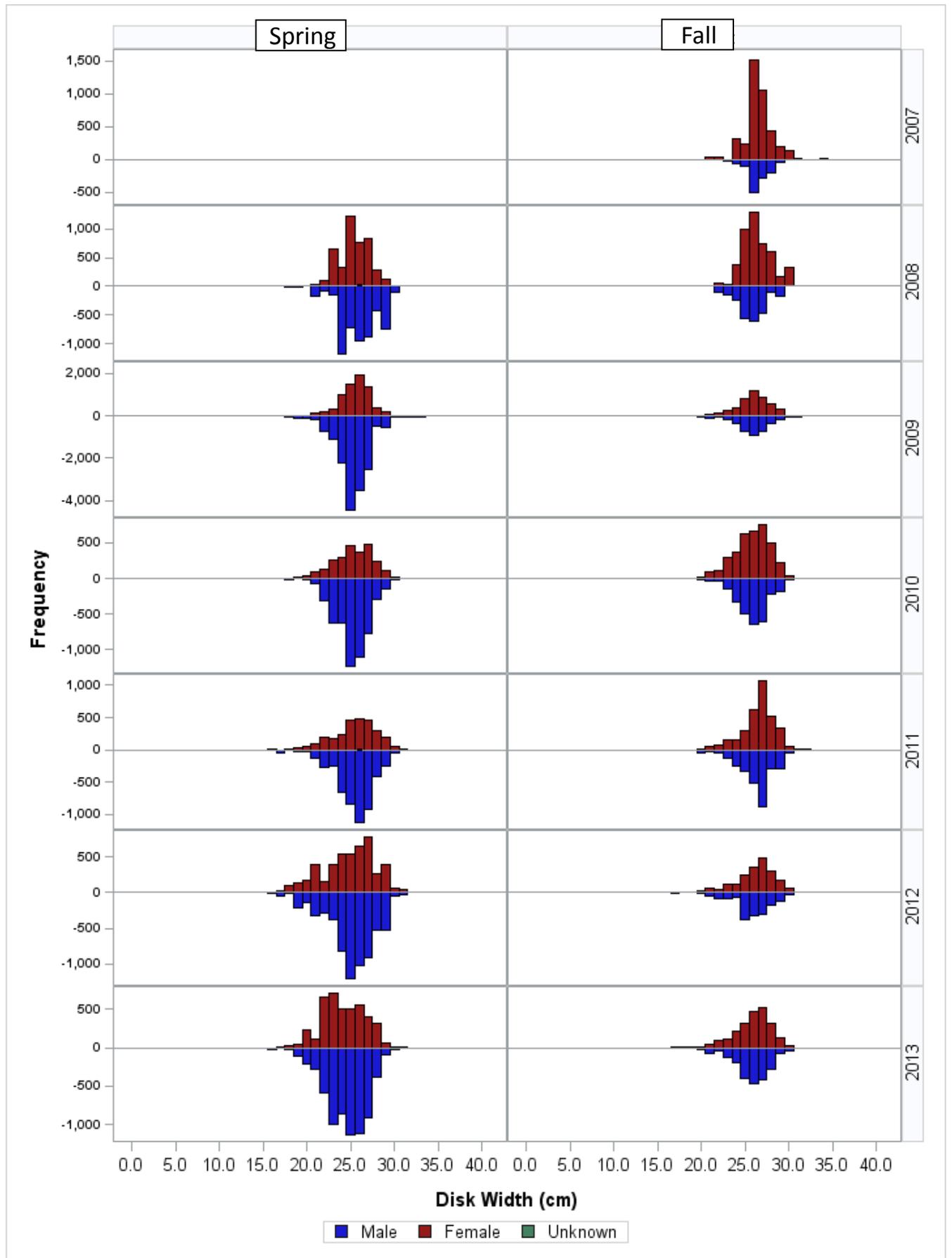


Figure 118. Little Skate sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

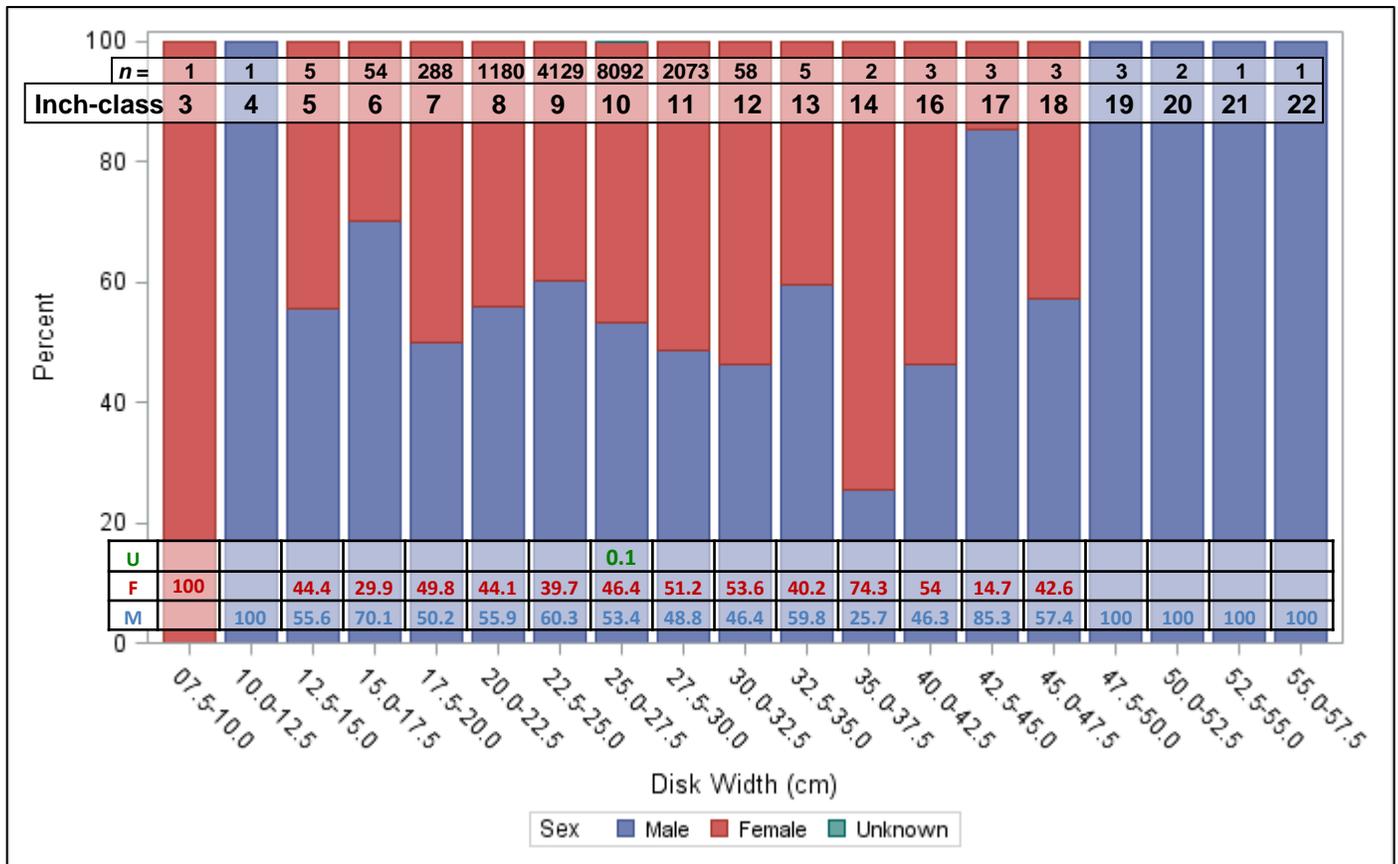


Figure 119. Little Skate maturity at length, by sex for all cruises pooled, 2007-2013.

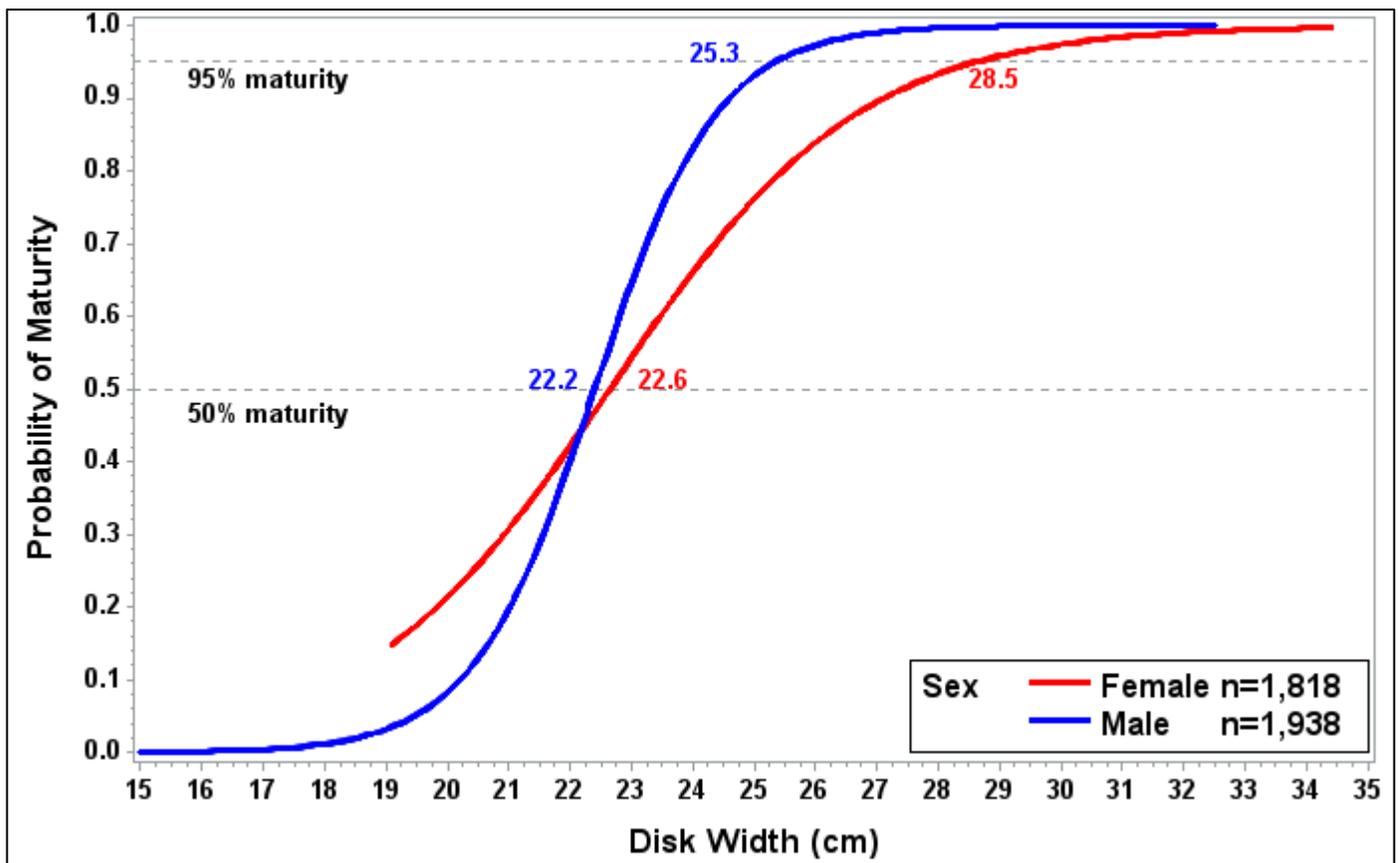
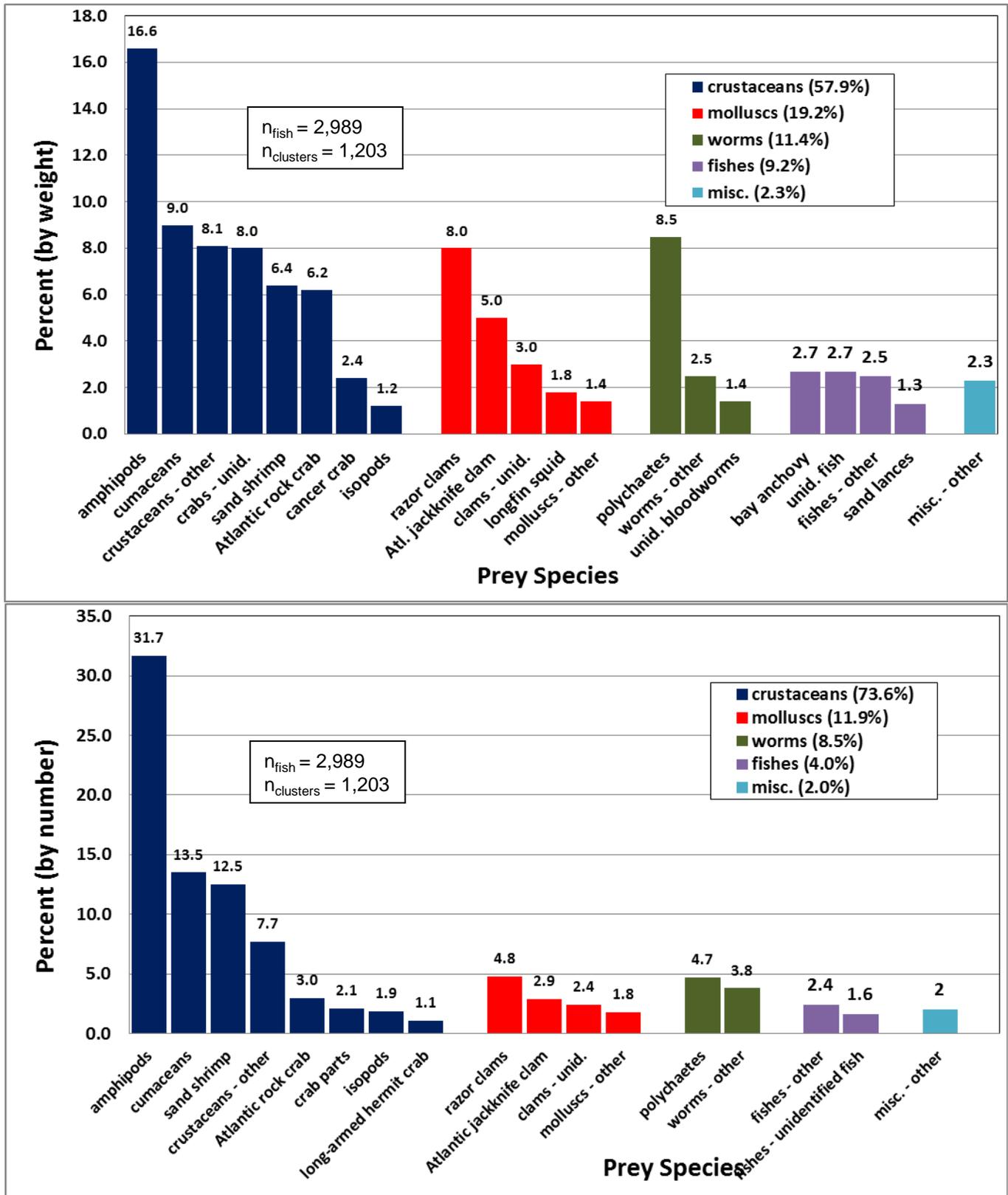


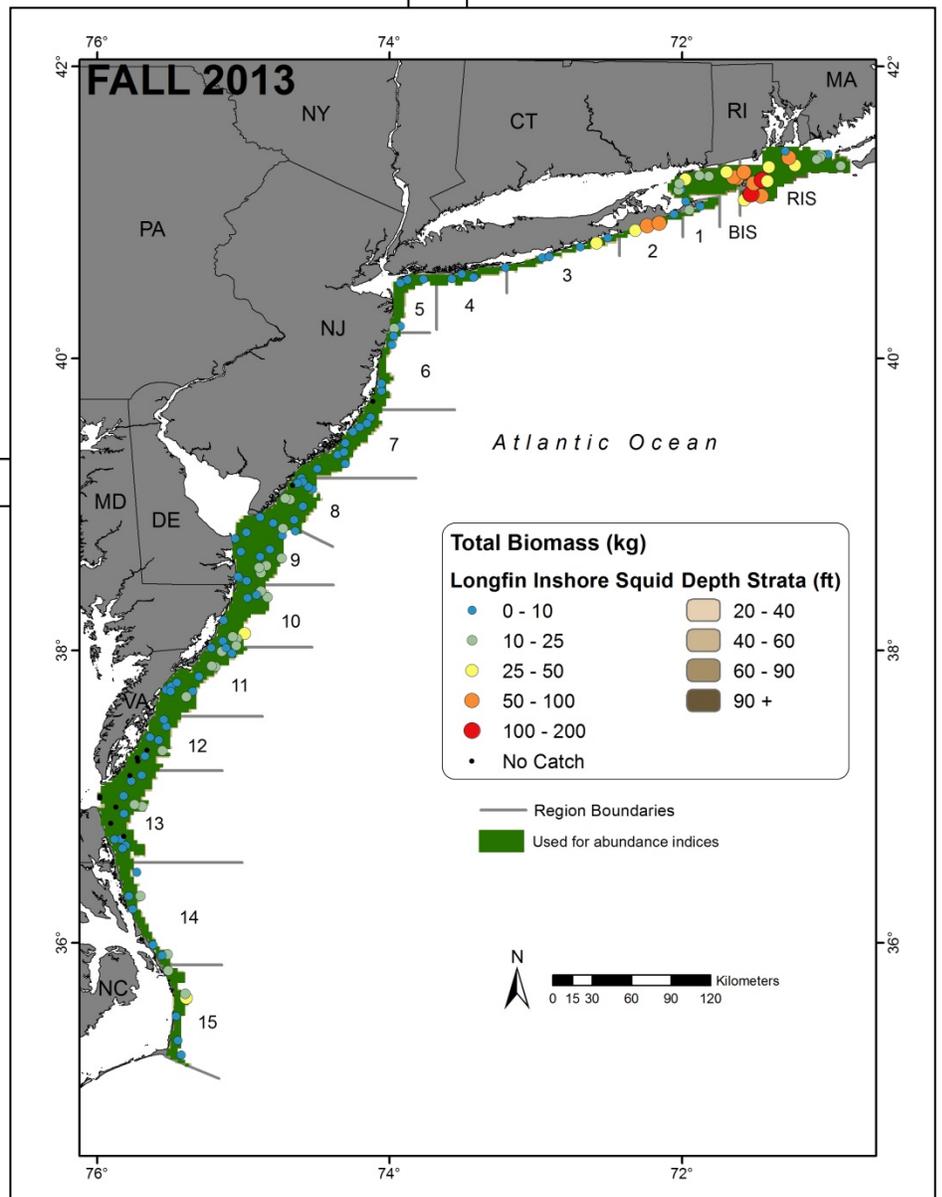
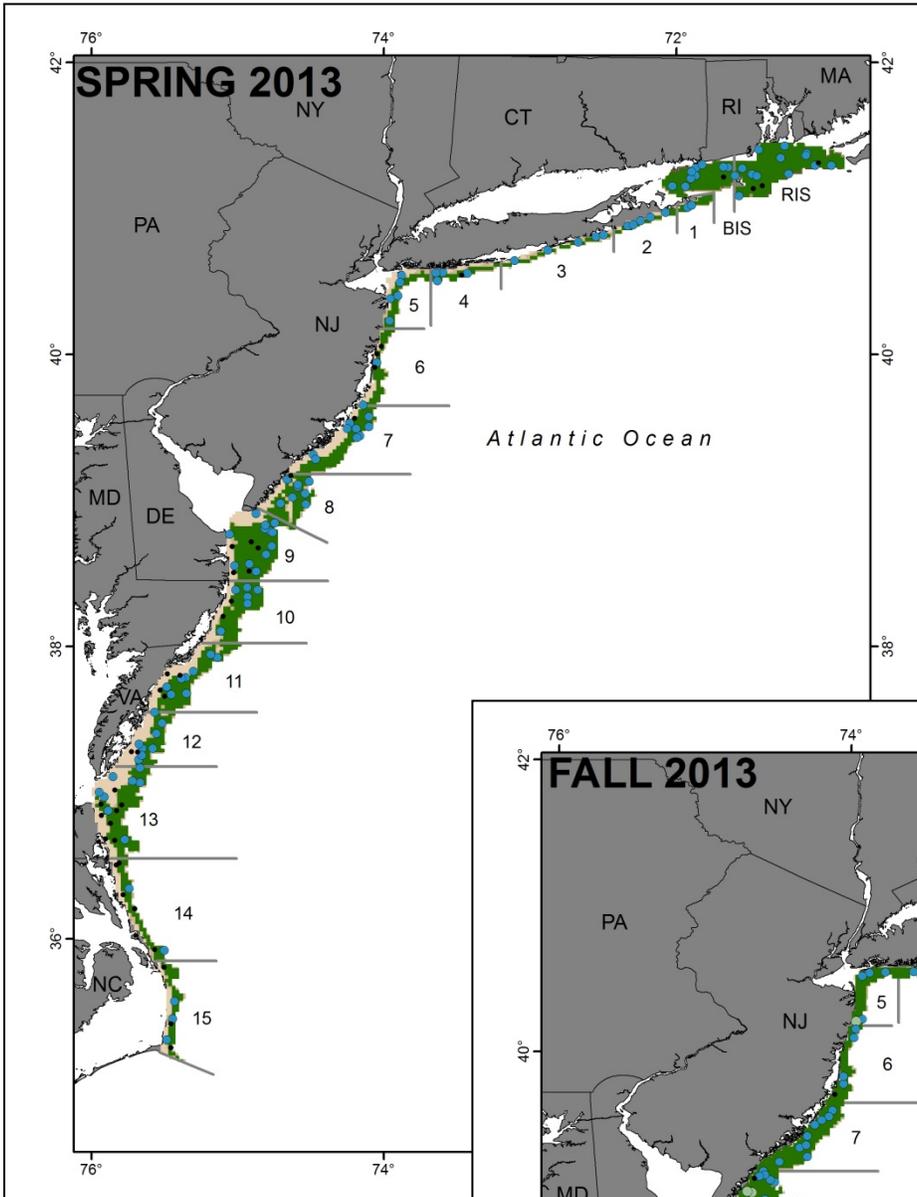
Figure 120. Little Skate diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Longfin Inshore Squid

Sampling Priority: E

Figure 121. Longfin Inshore Squid biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
VA	11	20-40		
		40-60		
		40-60		
NC	12	20-40		
	13	20-40		
		40-60		
NC	14	20-40		
		40-60		
		40-60		

Total Biomass (kg)

Longfin Inshore Squid Depth Strata (ft)

- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- No Catch
- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

— Region Boundaries
 ■ Used for abundance indices

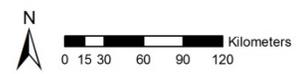


Table 42. Longfin Inshore Squid sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	19,549	776.2	5,127	N/A	N/A	N/A	N/A
	2009	12,451	501.6	5,710	N/A	N/A	N/A	N/A
	2010	7,502	316.2	2,396	N/A	N/A	N/A	N/A
	2011	9,579	416.4	6,492	N/A	N/A	N/A	N/A
	2012	46,920	1,360.5	17,073	N/A	N/A	N/A	N/A
	2013	2,078	103.0	2,078	N/A	N/A	N/A	N/A
Fall	2007	119,512	2,278.6	9,625	N/A	N/A	N/A	N/A
	2008	93,383	1,357.9	5,998	N/A	N/A	N/A	N/A
	2009	242,495	3,406.4	10,005	N/A	N/A	N/A	N/A
	2010	46,980	962.8	5,902	N/A	N/A	N/A	N/A
	2011	56,026	948.7	6,087	N/A	N/A	N/A	N/A
	2012	64,886	1,118.1	9,897	N/A	N/A	N/A	N/A
	2013	112,240	1,969.4	15,539	N/A	N/A	N/A	N/A

Table 43. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey										Fall Survey									
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index				
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI		
All	2007								All	2007	150	117.95	144.34	176.59	4.20	4.99	5.90		
	2008	107	43.59	56.82	73.99	2.71	3.35	4.11		2008	150	38.26	48.40	61.15	2.40	2.84	3.34		
	2009	109	26.79	33.63	42.16	1.60	1.95	2.34		2009	160	91.88	118.38	152.45	4.96	5.85	6.86		
	2010	108	5.27	7.04	9.30	0.49	0.67	0.86		2010	150	29.42	38.00	48.98	2.89	3.45	4.09		
	2011	108	19.78	27.25	37.39	1.12	1.45	1.82		2011	150	38.23	46.38	56.22	2.68	3.06	3.48		
	2012	108	85.71	119.50	166.47	3.79	4.78	5.96		2012	150	49.22	60.45	74.20	2.90	3.38	3.92		
	2013	107	4.13	5.28	6.68	0.38	0.49	0.61		2013	150	80.50	102.08	129.39	4.92	5.92	7.10		
	2014									2014									
	2015									2015									
	2016									2016									

Figure 122. Longfin Inshore Squid geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

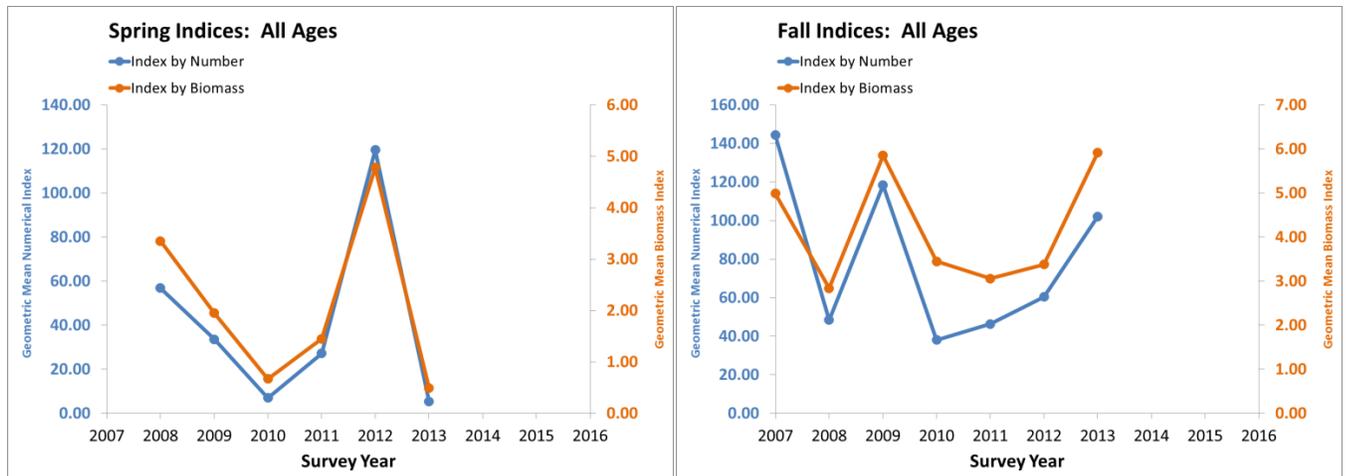


Figure 123. Longfin Inshore Squid length-frequency distributions, by cruise.

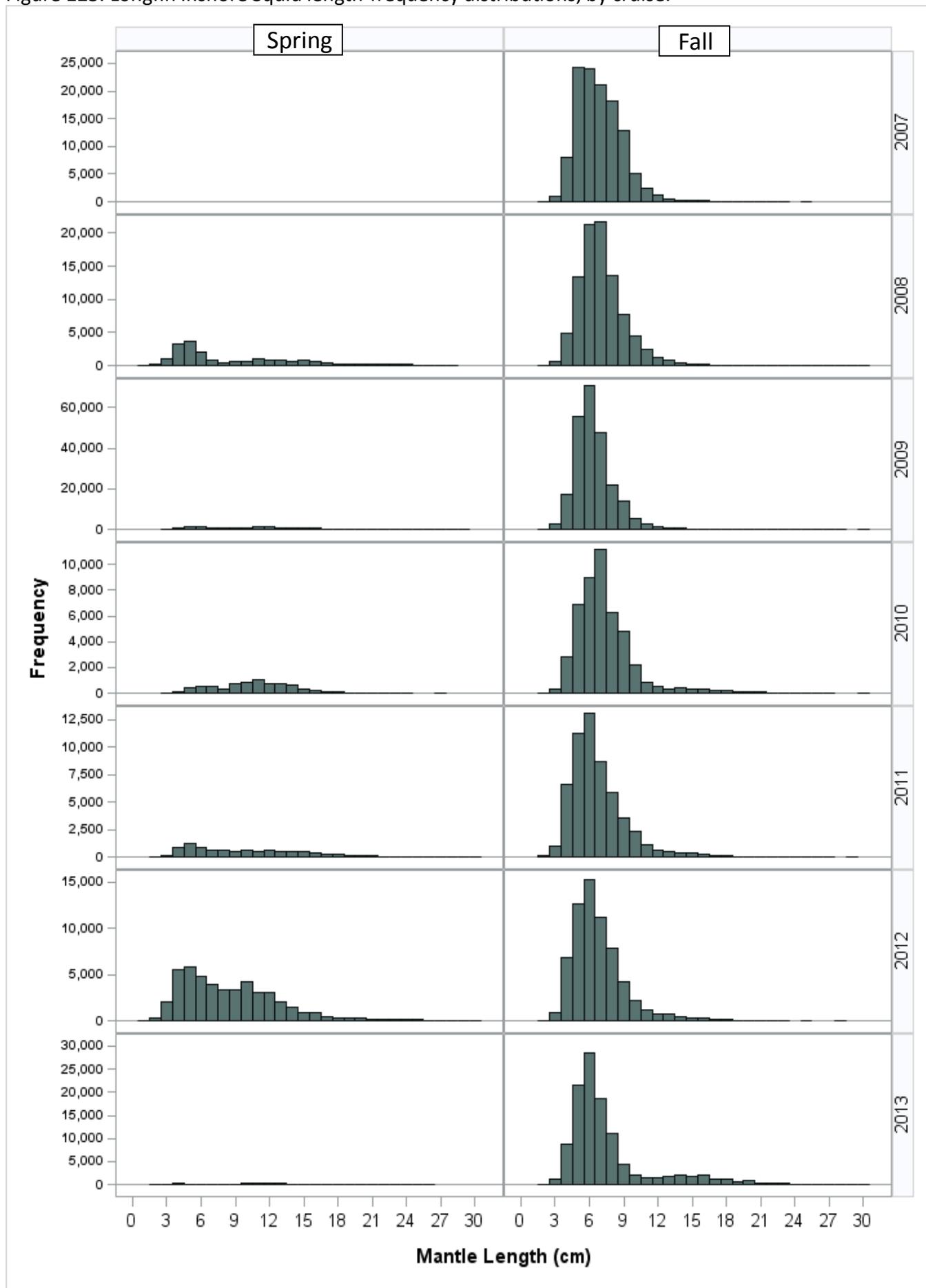


Figure 124. Longfin Inshore Squid length-frequency distributions, by cruise and sex, 2013 only.

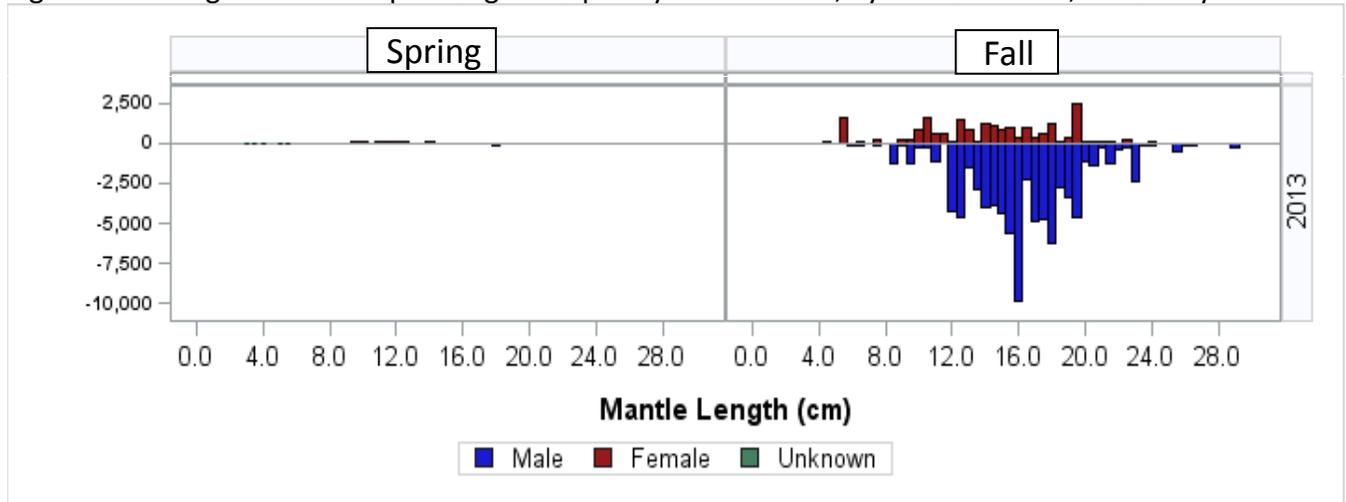
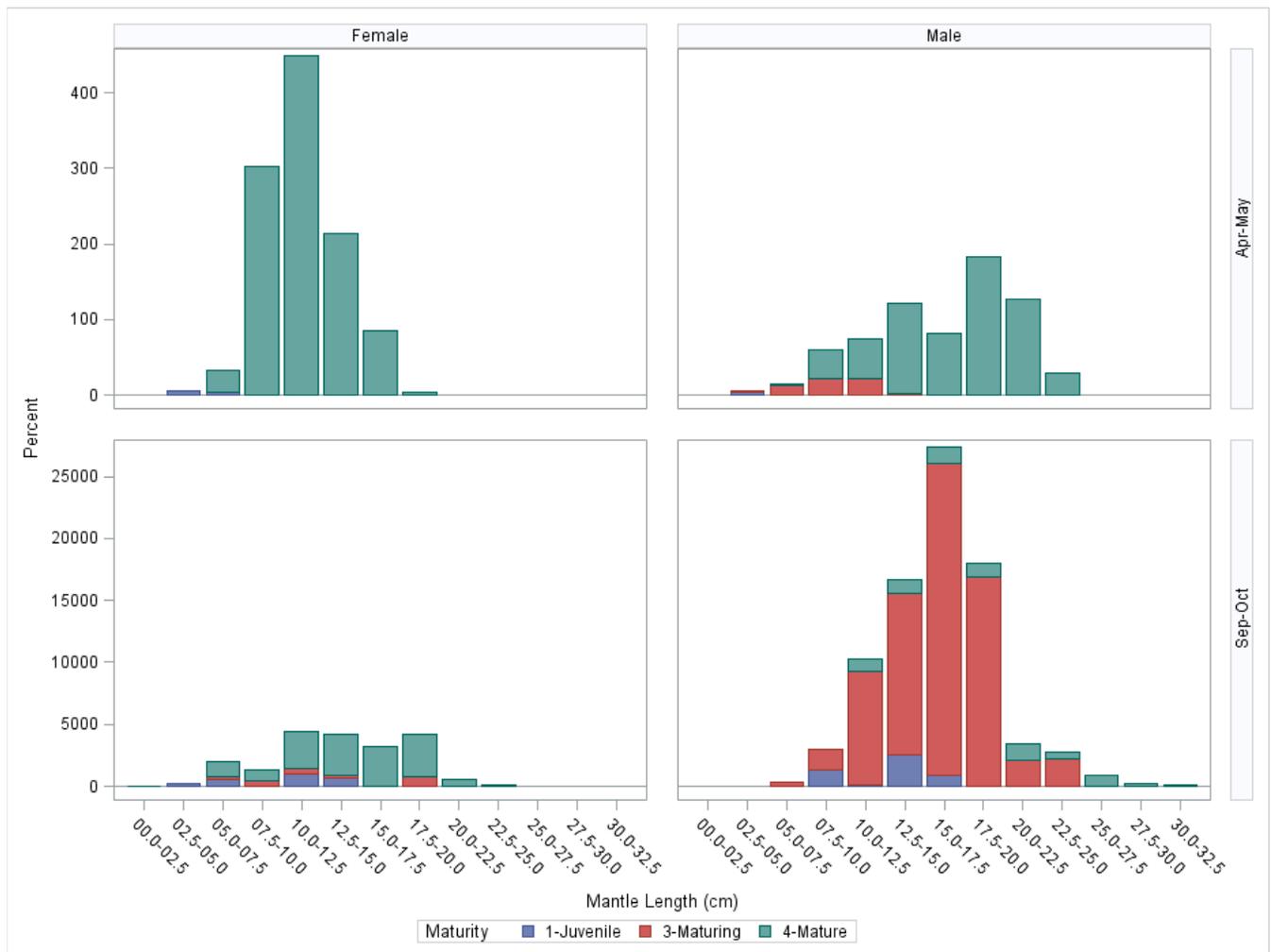


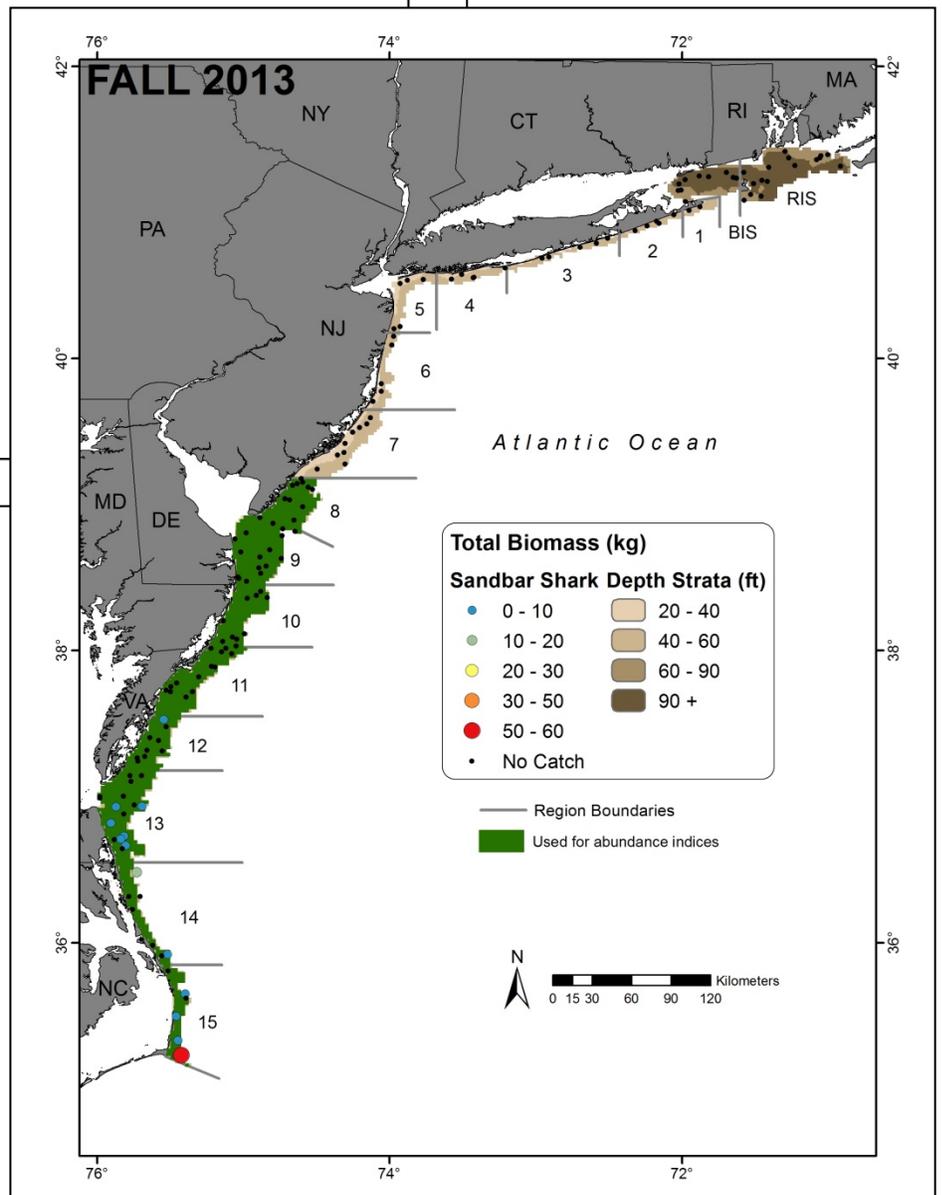
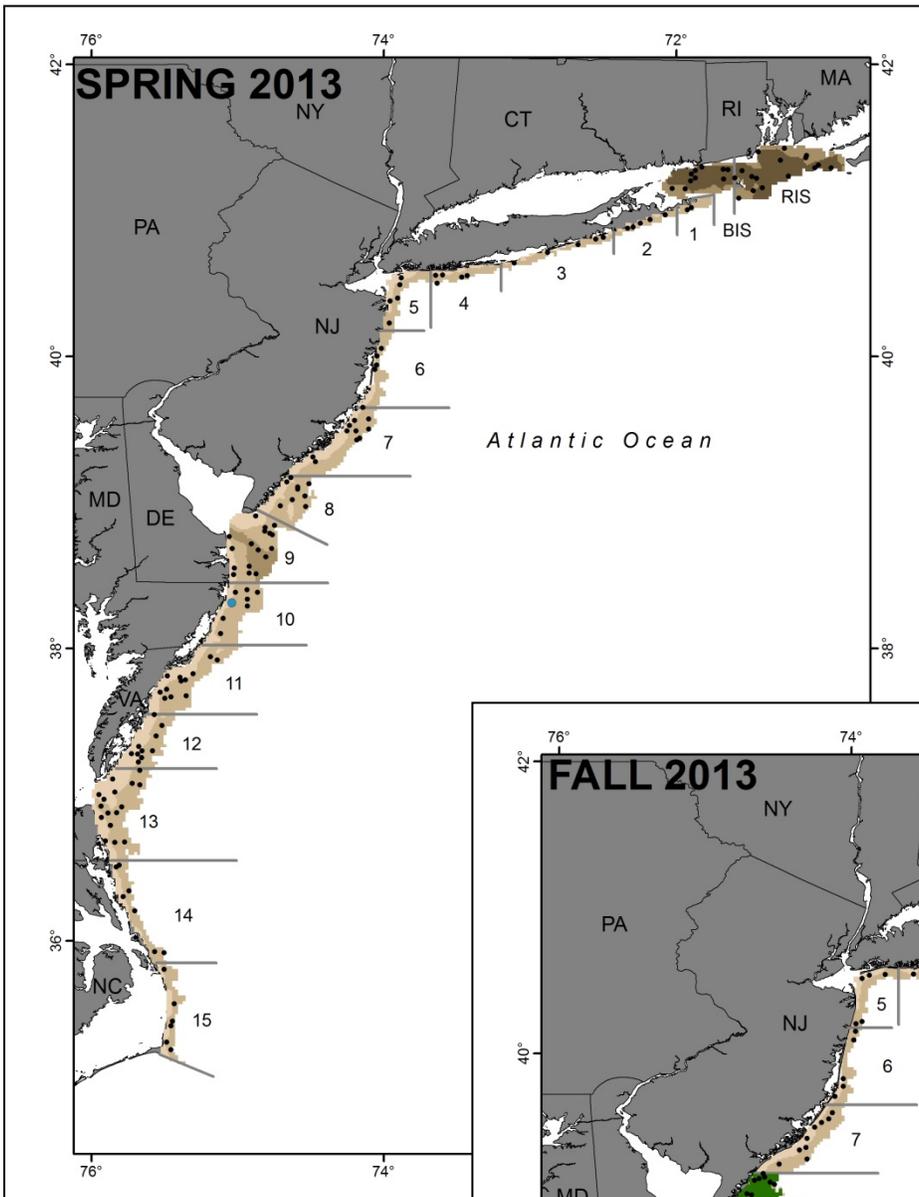
Figure 125. Longfin Inshore Squid maturity classification by season and sex, 2013 only.



Sandbar Shark

Sampling Priority: E

Figure 126. Sandbar Shark biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
NY	01	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
NJ	06	20-40		
		40-60		
		20-40		
		40-60		
		20-40		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		20-40		
NC	14	20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 44. Sandbar Shark sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	5	14.4	5	N/A	N/A	N/A	N/A
	2009				N/A	N/A	N/A	N/A
	2010	3	7.3	3	N/A	N/A	N/A	N/A
	2011	7	20.9	7	N/A	N/A	N/A	N/A
	2012	5	14.2	5	N/A	N/A	N/A	N/A
	2013	1	1.0	1	N/A	N/A	N/A	N/A
Fall	2007	15	100.1	15	9	N/A	N/A	N/A
	2008	12	36.0	12	N/A	N/A	N/A	N/A
	2009	5	10.8	5	N/A	N/A	N/A	N/A
	2010	81	202.2	81	N/A	N/A	N/A	N/A
	2011	43	116.6	43	N/A	N/A	N/A	N/A
	2012	58	167.6	58	N/A	N/A	N/A	N/A
	2013	28	107.7	28	N/A	N/A	N/A	N/A

Table 45. Sandbar Shark geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	87	0.01	0.08	0.16	0.03	0.20	0.40
	2008	87	0.04	0.09	0.13	0.07	0.18	0.30
	2009	91	0.00	0.04	0.08	0.00	0.07	0.14
	2010	87	0.15	0.26	0.37	0.24	0.39	0.56
	2011	87	0.16	0.26	0.37	0.29	0.48	0.70
	2012	87	0.19	0.31	0.45	0.37	0.61	0.90
	2013	88	0.09	0.18	0.29	0.15	0.32	0.53
	2014							
	2015							
	2016							

Figure 127. Sandbar Shark geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

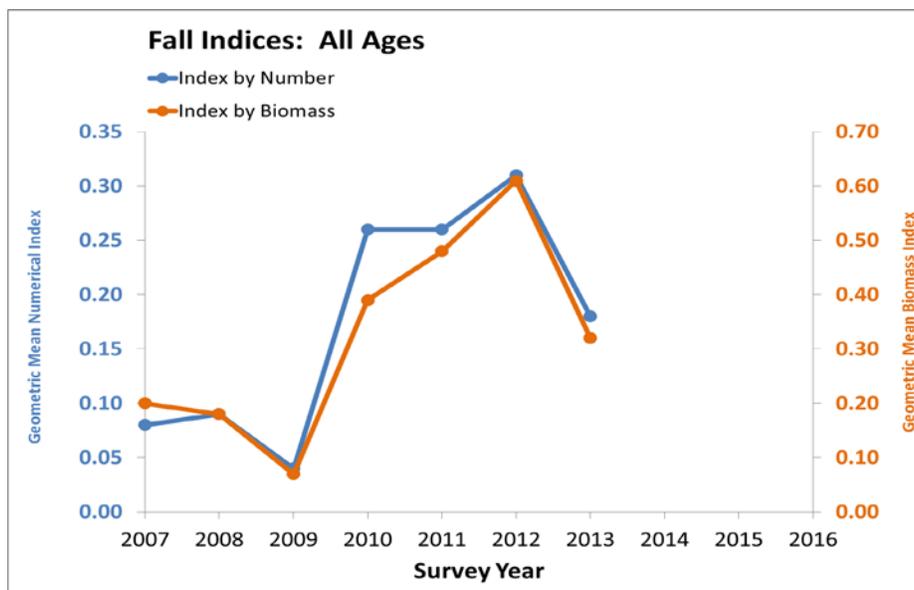


Figure 128. Sandbar Shark length-frequency distributions, by cruise.

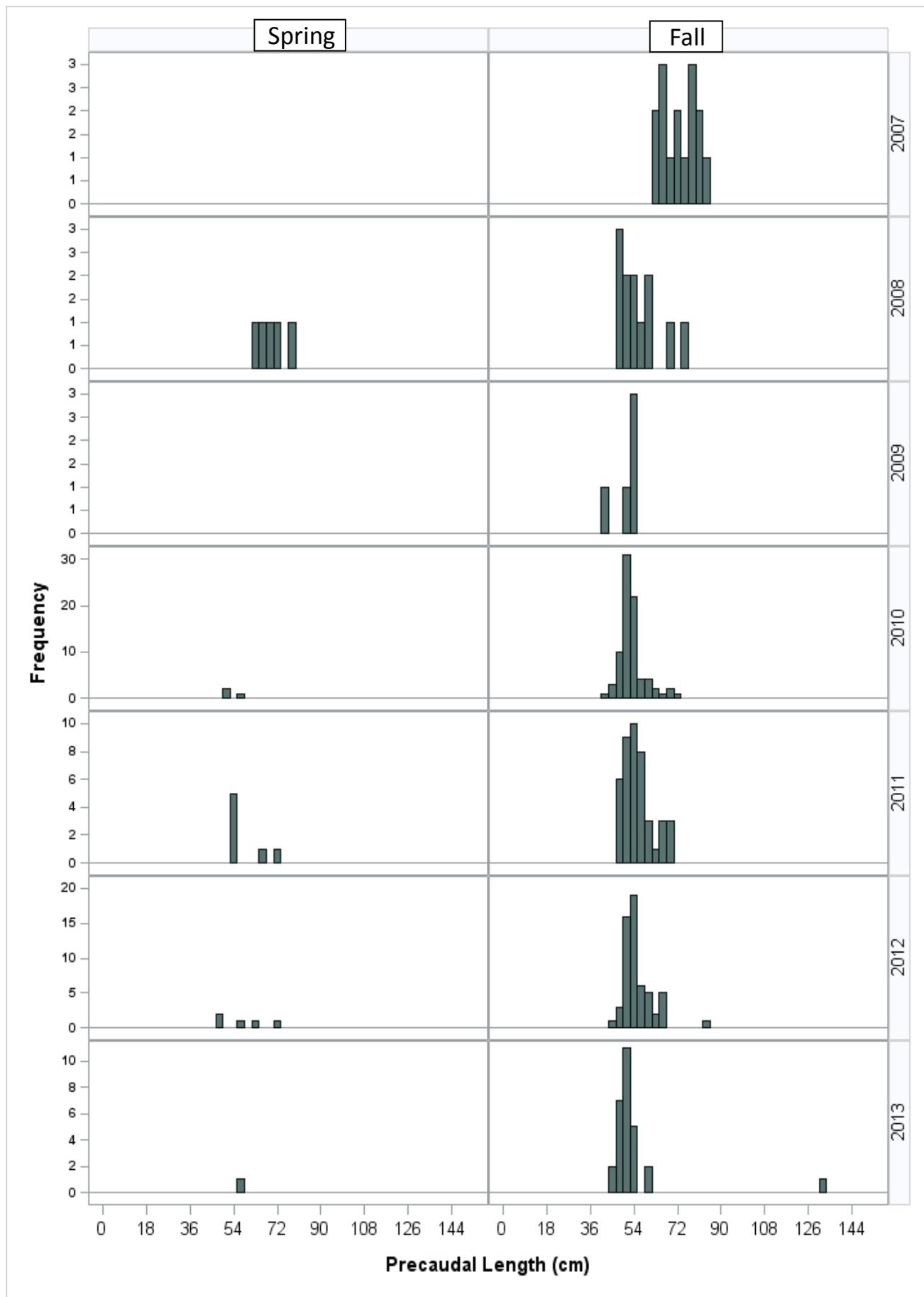


Figure 129. Sandbar Shark length-frequency distributions, by cruise and sex.

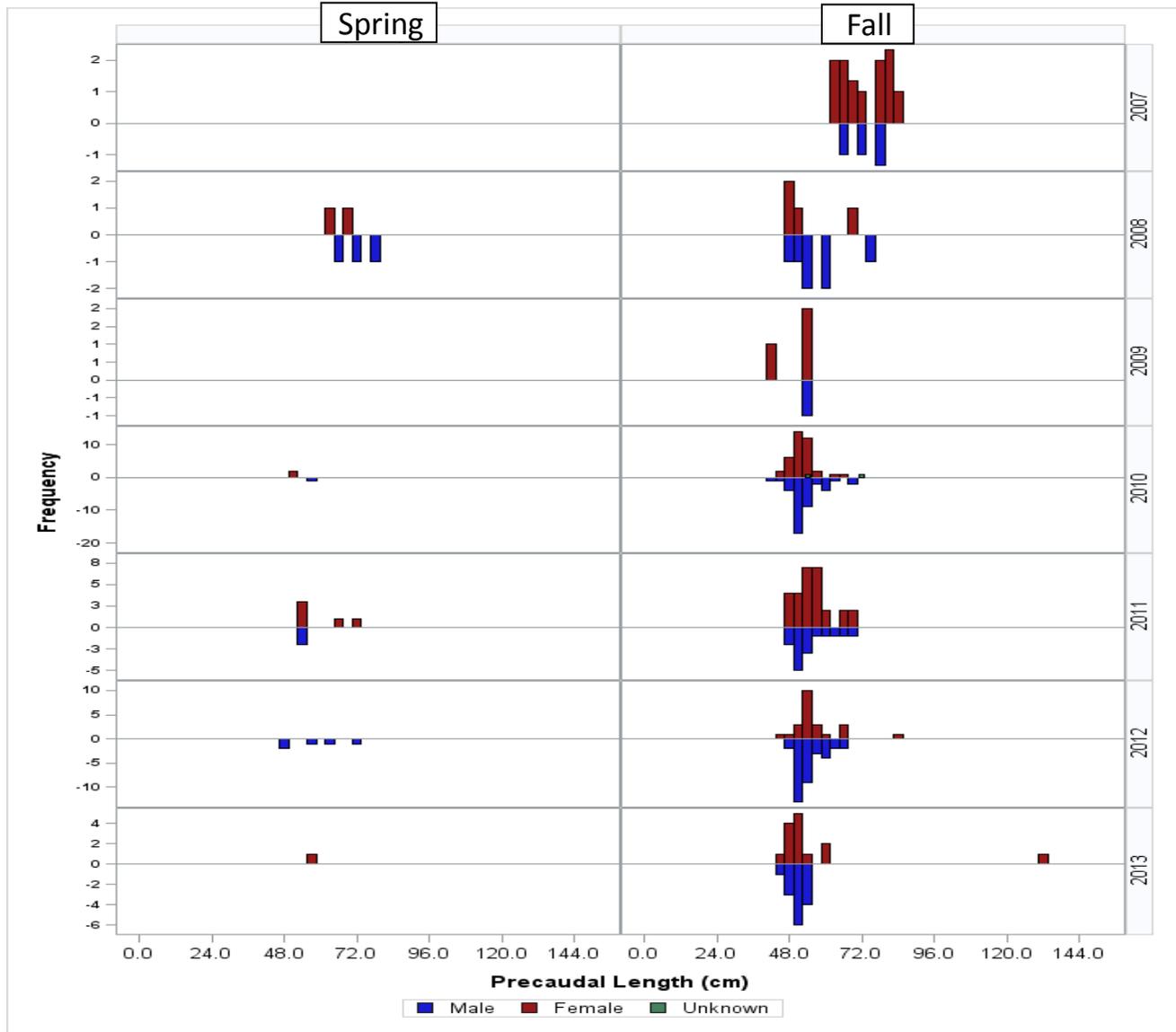
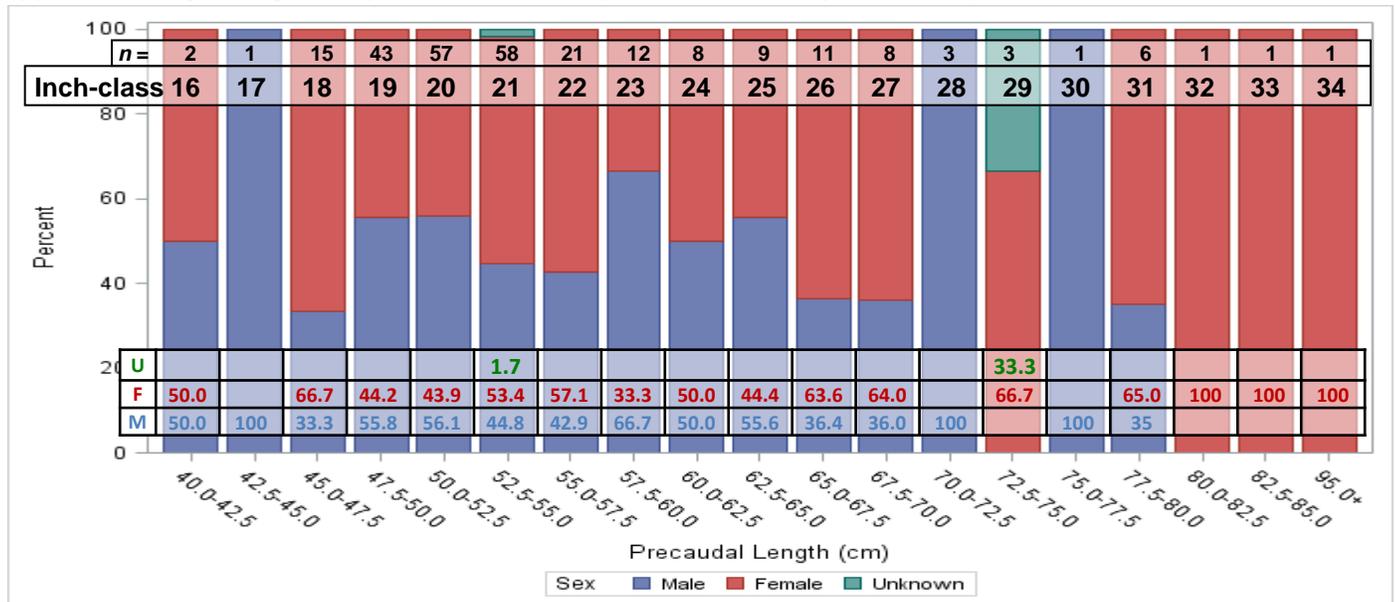


Figure 130. Sandbar Shark sex ratio, by length group, for all cruises pooled, 2007-2013.

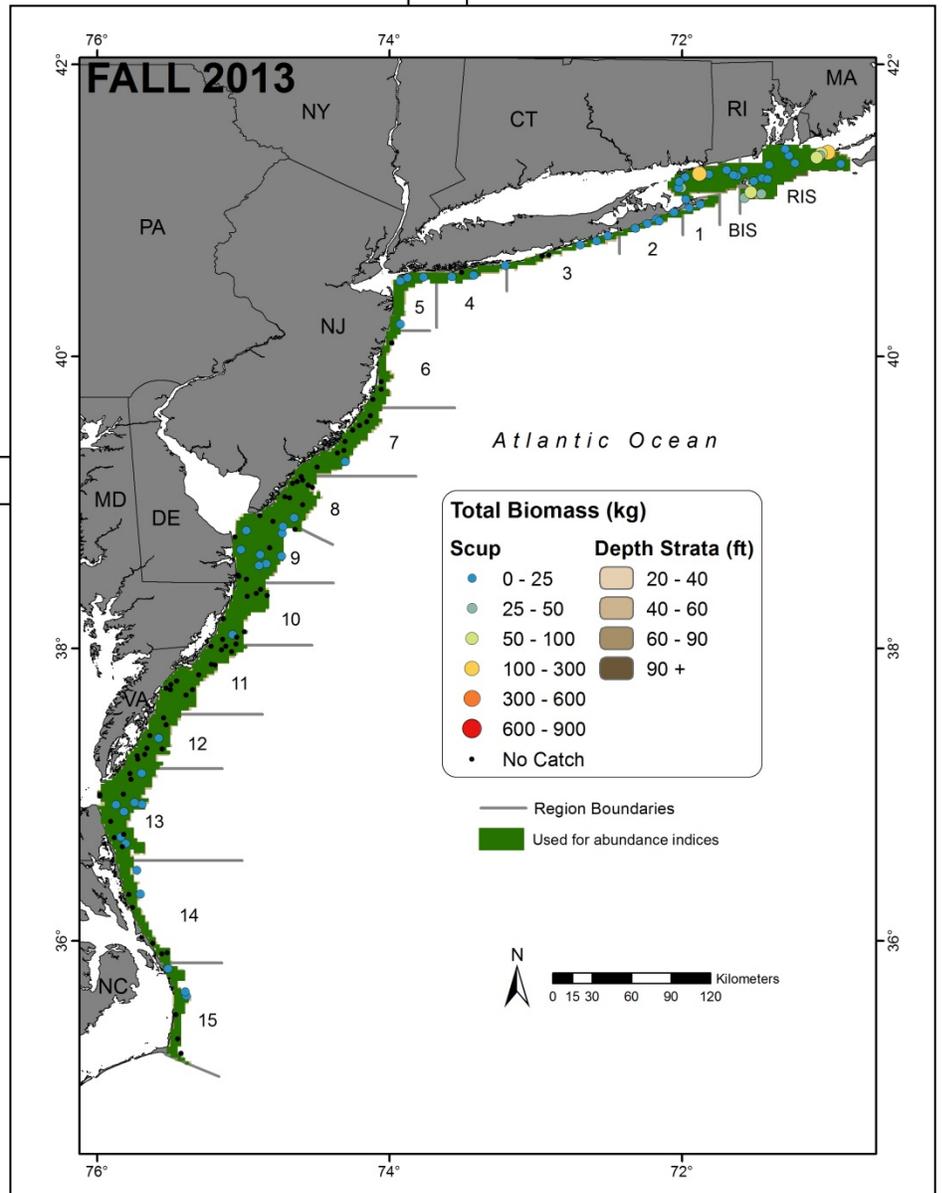
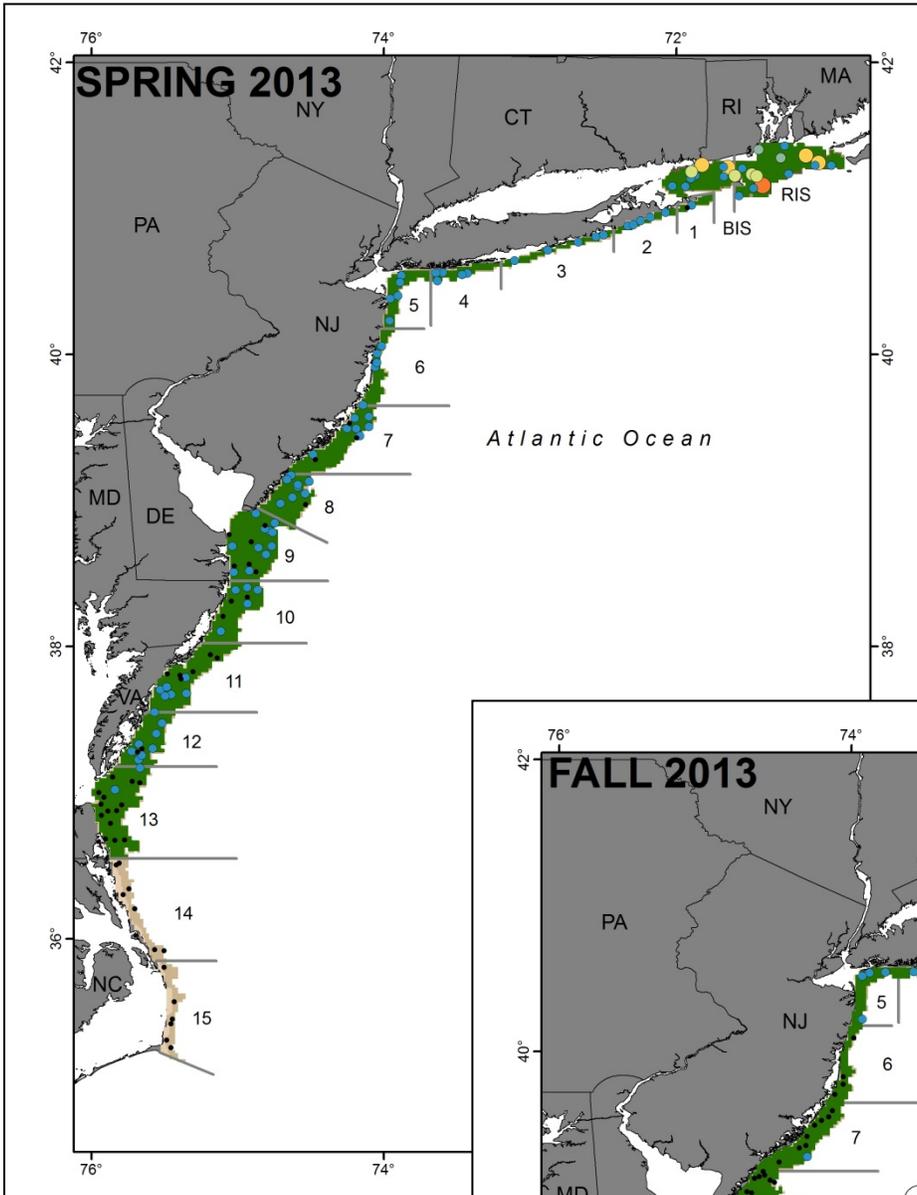
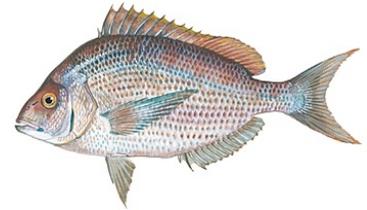
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)



Scup

Sampling Priority: A

Figure 131. Scup biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[Green Box]	[Green Box]
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
	09	60-90		
MD	10	20-40		
	10	40-60		
VA	11	20-40		
	11	40-60		
	11	40-60		
NC	14	20-40	[Grey Box]	
	14	40-60	[Grey Box]	
	14	20-40	[Grey Box]	
NC	15	20-40	[Grey Box]	
	15	40-60	[Grey Box]	

Total Biomass (kg)

Scup	Depth Strata (ft)
● 0 - 25	■ 20 - 40
● 25 - 50	■ 40 - 60
● 50 - 100	■ 60 - 90
● 100 - 300	■ 90 +
● 300 - 600	
● 600 - 900	
● No Catch	

— Region Boundaries
 ■ Used for abundance indices

N
 0 15 30 60 90 120 Kilometers

Table 46. Scup sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	51,629	1,256.1	7,167	869	869	754	744
	2009	16,884	2,827.3	7,043	743	740	714	702
	2010	4,209	928.5	2,287	465	465	404	321
	2011	3,007	755.9	1,812	451	451	369	353
	2012	70,112	1,477.1	11,289	658	658	551	512
	2013	9,755	1,555.7	4,083	553	0	335	320
Fall	2007	276,237	3,928.8	13,721	811	811	803	795
	2008	77,858	2,503.2	6,946	671	671	669	666
	2009	158,567	2,577.8	12,792	897	897	892	729
	2010	131,471	3,959.2	14,006	727	727	717	699
	2011	64,928	1,906.3	7,944	624	624	597	553
	2012	88,163	1,814.7	10,950	696	696	636	624
	2013	43,604	857.1	5,622	372	0	308	0

Table 47. Scup geometric mean indices of abundance, for all specimens captured by number and biomass and by age-class for spring and fall NEAMAP surveys.

Spring Survey							Fall Survey										
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	150	79.77	117.65	173.28	5.78	7.63	9.98
	2008	137	24.53	32.86	43.90	1.87	2.37	2.96	2008	150	17.12	24.52	34.93	2.42	3.15	4.04	
	2009	145	5.87	8.17	11.23	1.00	1.44	1.99	2009	160	28.79	40.86	57.83	3.11	3.94	4.95	
	2010	137	1.74	2.26	2.87	0.57	0.79	1.03	2010	150	21.67	31.08	44.41	2.44	3.34	4.47	
	2011	137	1.79	2.38	3.10	0.38	0.59	0.83	2011	150	9.46	13.67	19.58	1.71	2.29	3.00	
	2012	137	14.39	20.64	29.42	1.23	1.68	2.21	2012	150	12.07	16.59	22.68	1.76	2.27	2.87	
	2013	137	4.05	5.26	6.77	0.89	1.17	1.51	2013	150	3.49	4.55	5.87	0.64	0.84	1.05	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	150	40.64	59.72	87.54	2.86	3.76	4.87
	2008								2008	150	8.46	11.86	16.47	1.13	1.47	1.87	
	2009								2009	160	17.34	24.06	33.23	1.64	2.07	2.58	
	2010								2010	150	14.53	21.19	30.71	1.45	2.04	2.77	
	2011								2011	150	4.79	6.91	9.81	0.74	1.02	1.34	
	2012								2012	150	7.37	9.99	13.44	0.89	1.17	1.49	
	2013								2013	150	2.67	3.44	4.39	0.44	0.59	0.75	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007								1	2007	150	19.14	26.83	37.45	2.52	3.29	4.23
	2008	137	14.13	18.82	24.95	0.90	1.17	1.48	2008	150	8.54	11.96	16.60	1.30	1.71	2.19	
	2009	145	2.48	3.27	4.24	0.24	0.33	0.42	2009	160	15.85	21.81	29.86	1.80	2.29	2.86	
	2010	137	0.42	0.62	0.84	0.03	0.05	0.08	2010	150	6.09	8.41	11.48	0.74	1.07	1.46	
	2011	137	0.73	0.91	1.11	0.05	0.08	0.11	2011	150	5.51	7.81	10.91	1.09	1.45	1.87	
	2012	137	12.48	17.90	25.51	0.92	1.29	1.73	2012	150	3.50	4.82	6.54	0.80	1.10	1.46	
	2013	137	1.67	2.25	2.96	0.18	0.29	0.40	2013	150	1.76	2.30	2.94	0.32	0.45	0.59	
	2014								2014								
	2015								2015								
	2016								2016								
2+	2007								2+	2007	150	2.74	3.60	4.67	0.43	0.58	0.74
	2008	137	6.40	8.15	10.32	0.90	1.13	1.39	2008	150	1.69	2.30	3.05	0.46	0.65	0.86	
	2009	145	3.95	5.47	7.46	0.82	1.21	1.69	2009	160	3.16	4.18	5.46	0.51	0.68	0.88	
	2010	137	1.16	1.51	1.91	0.55	0.76	1.00	2010	150	2.20	3.10	4.24	0.45	0.68	0.94	
	2011	137	1.01	1.40	1.88	0.34	0.55	0.78	2011	150	1.43	1.94	2.55	0.40	0.58	0.78	
	2012	137	2.54	3.44	4.57	0.41	0.57	0.74	2012	150	0.49	0.71	0.97	0.16	0.26	0.38	
	2013	137	2.41	3.10	3.94	0.79	1.06	1.38	2013	150	0.55	0.79	1.07	0.19	0.33	0.48	
	2014								2014								
	2015								2015								
	2016								2016								

Figure 132. Scup geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.



Figure 133. Scup length-frequency distributions, by cruise.

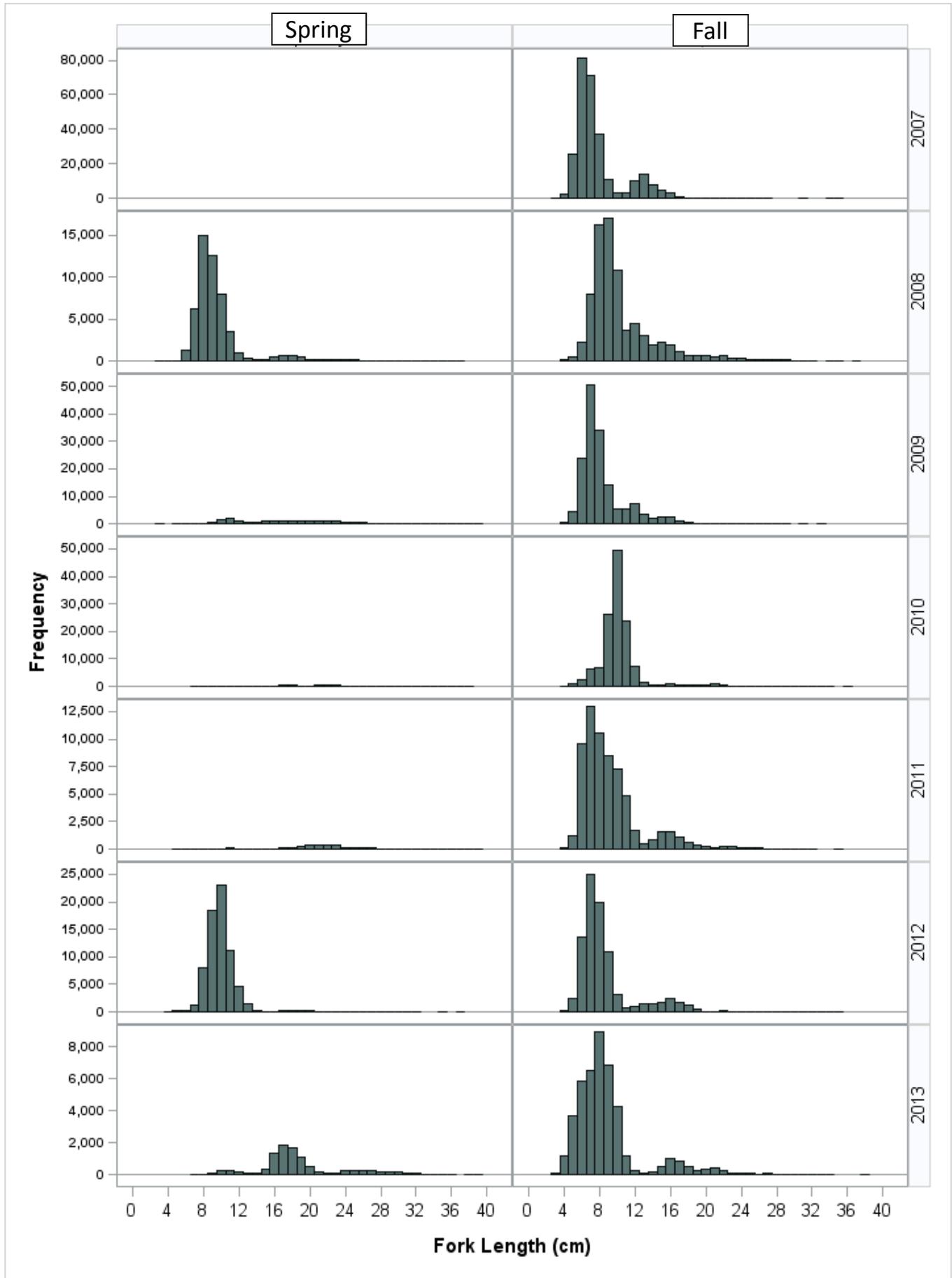


Figure 134. Scup age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar. (Values in red were generated by application of age-length keys.)

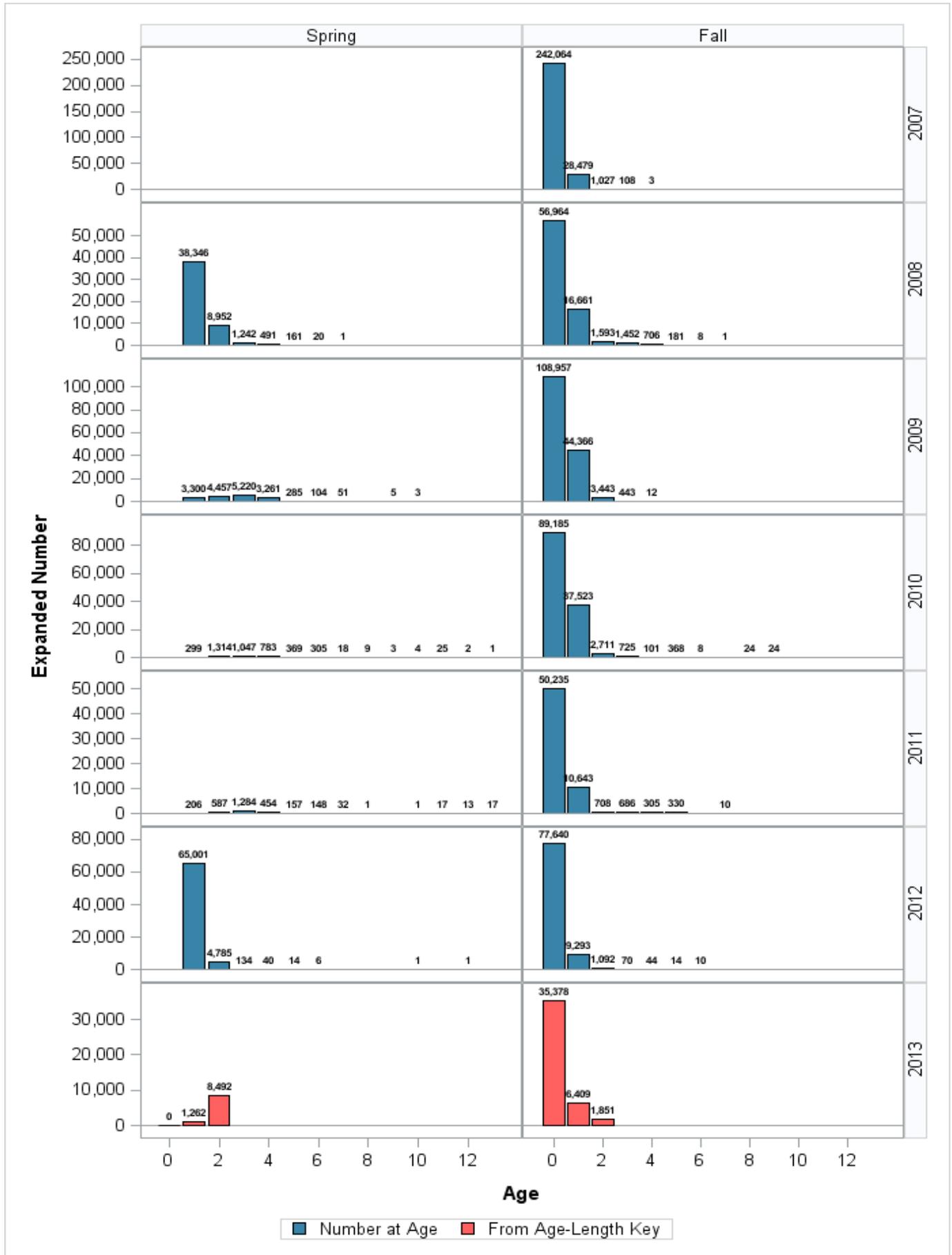


Figure 135. Scup catch-at-age standardized to 3,000 trawl minutes, by cruise. (Values in red were generated by application of age-length keys.)

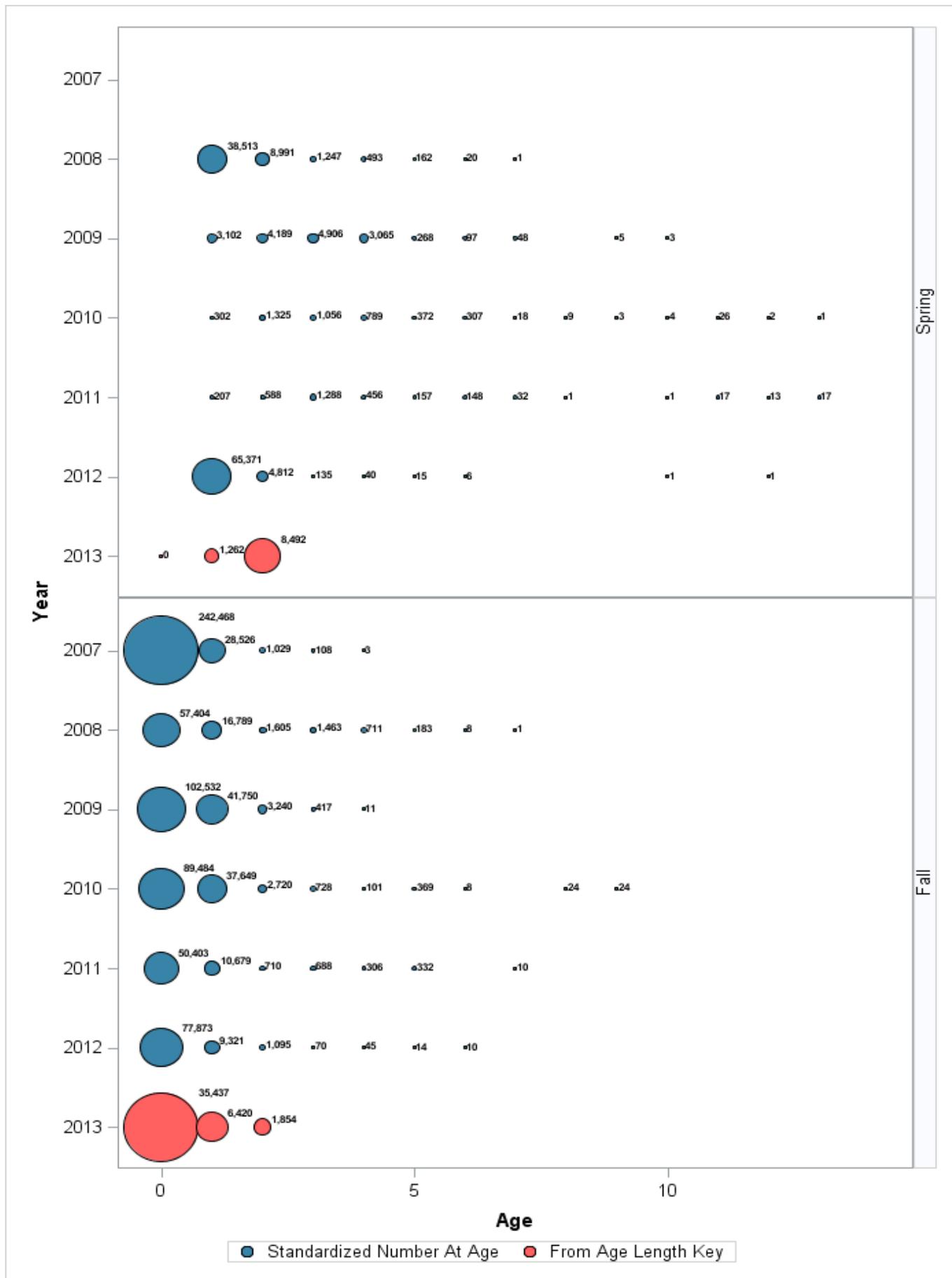


Figure 136. Scup sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

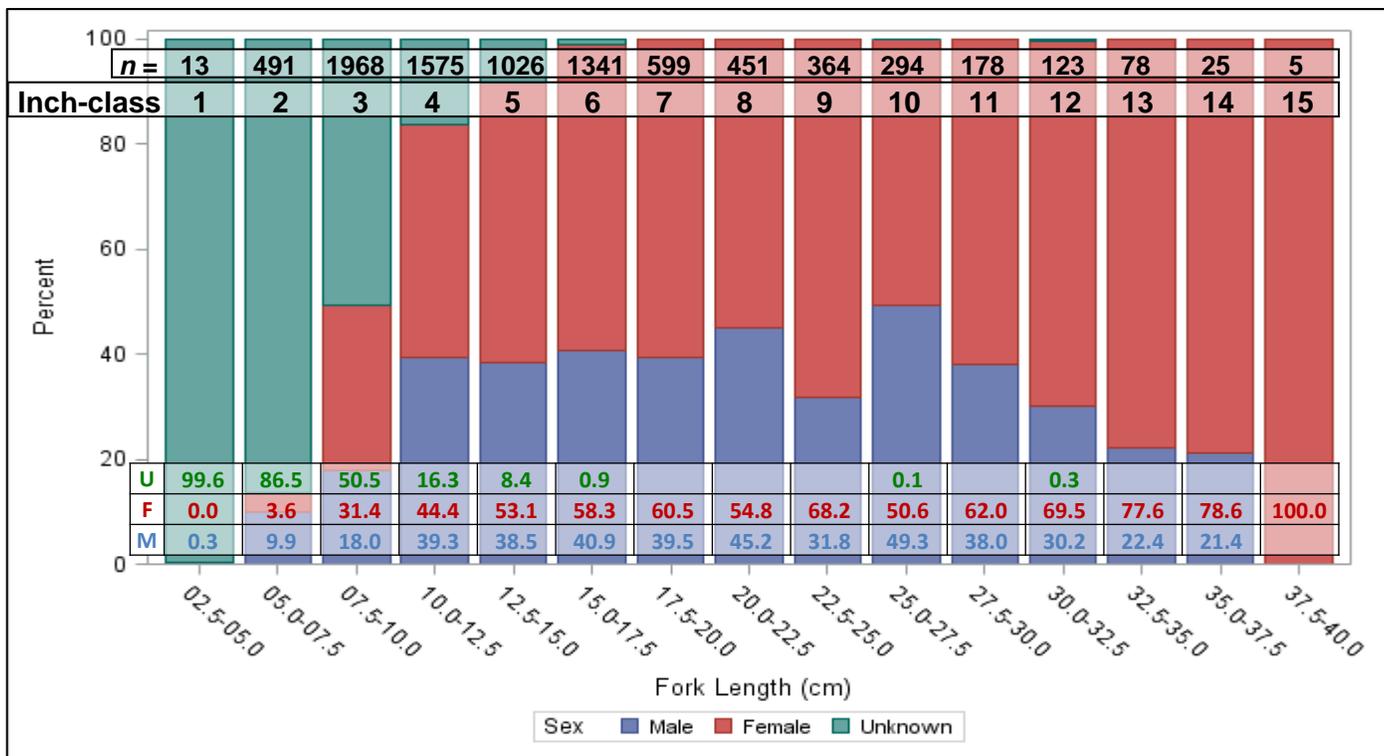


Figure 137. Scup maturity at length, by sex for all cruises pooled, 2007-2013.

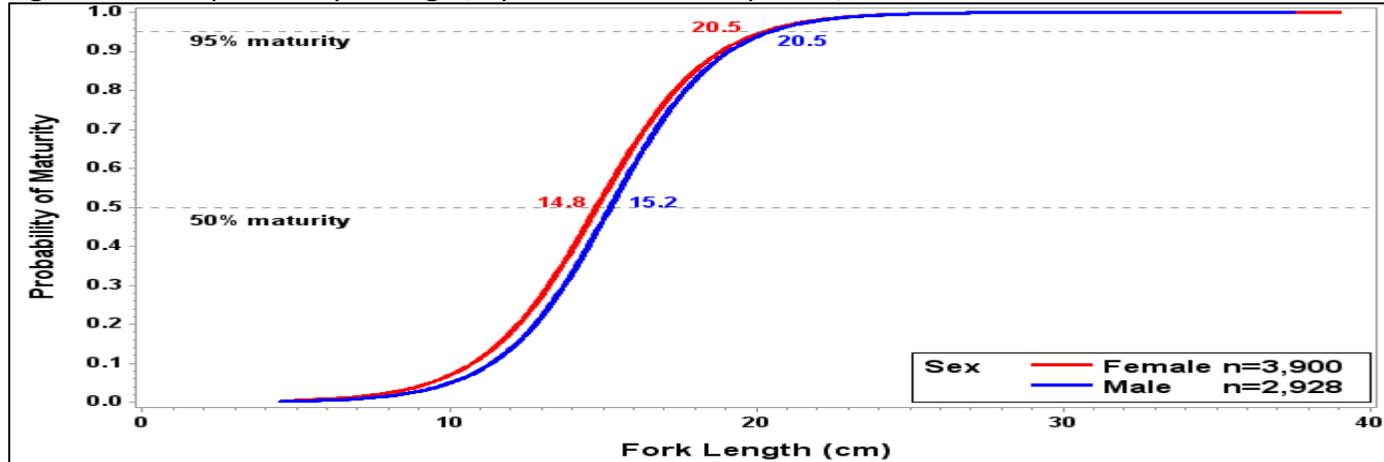


Figure 138. Scup maturity at age, by sex for all cruises pooled, 2007-2013.

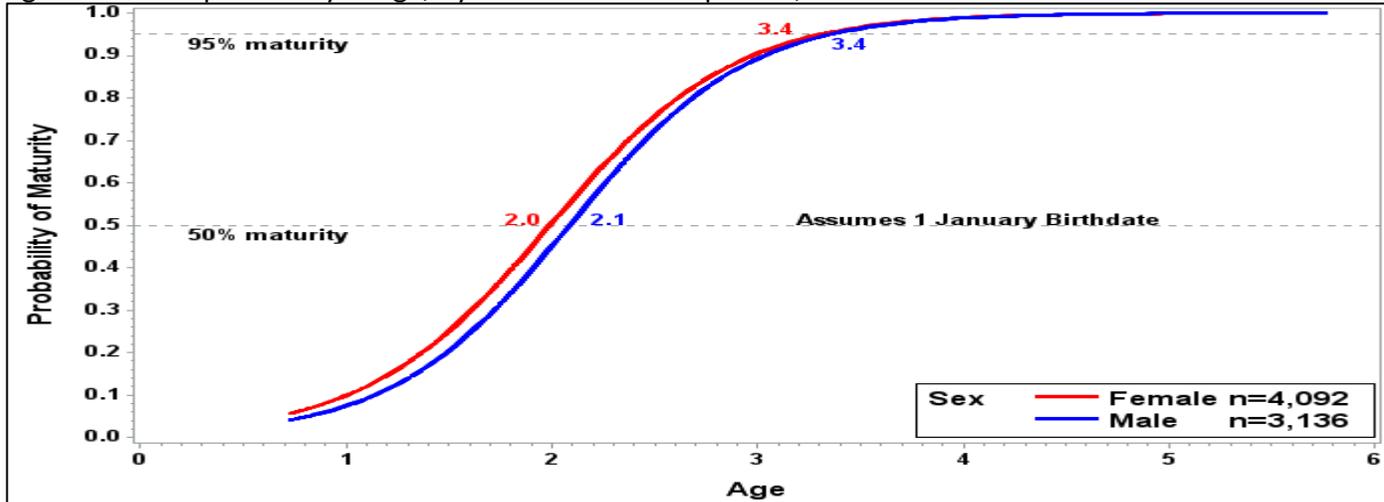
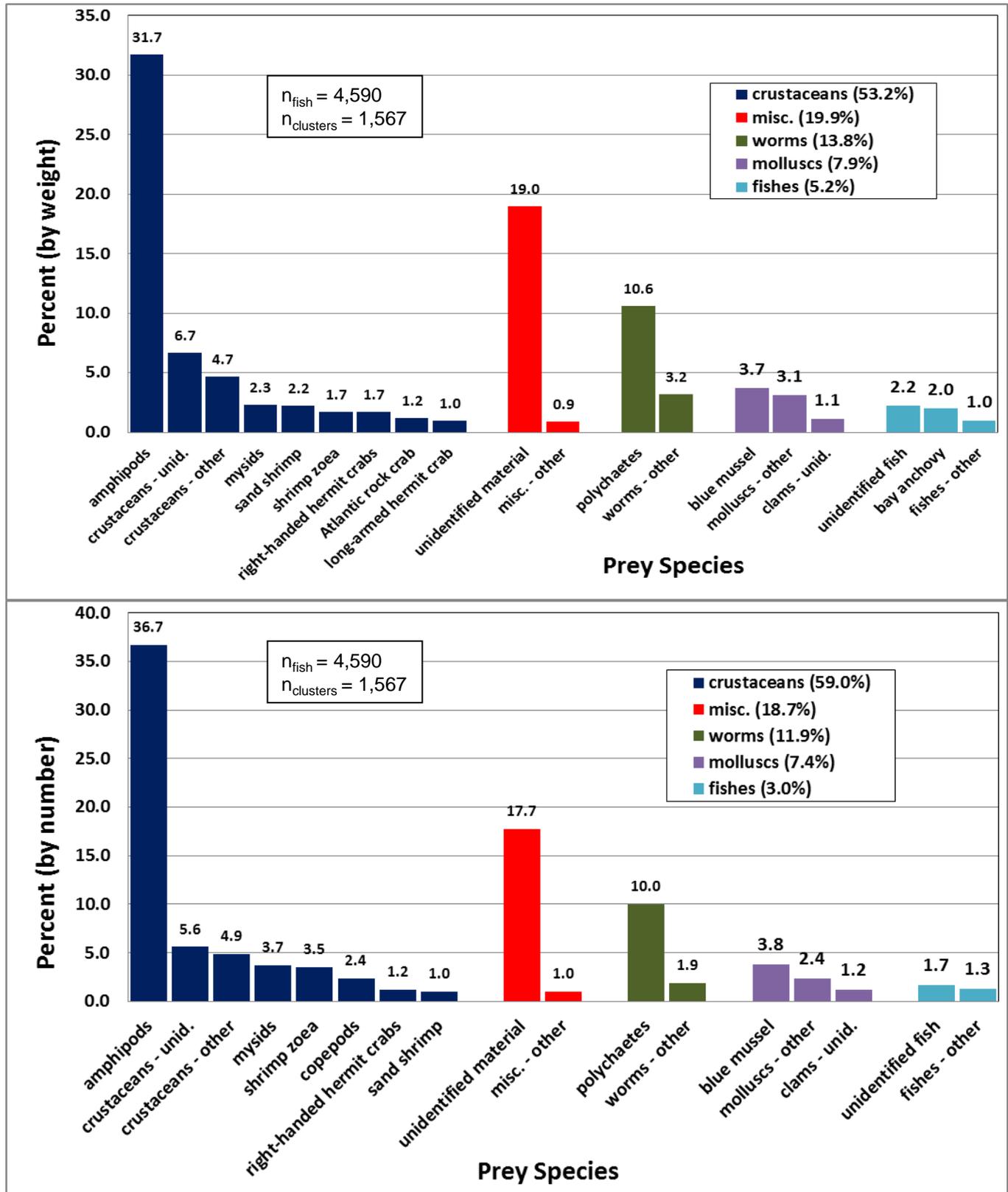


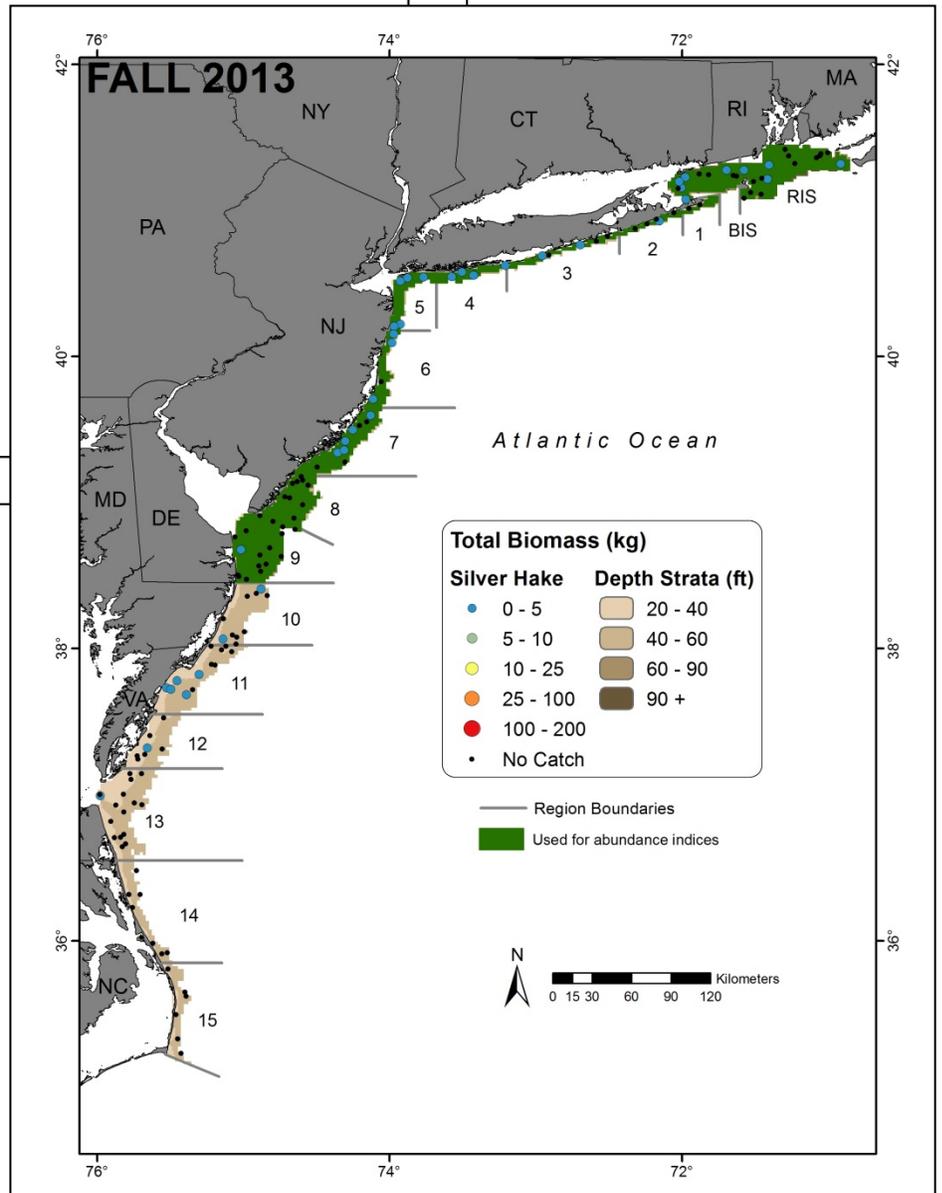
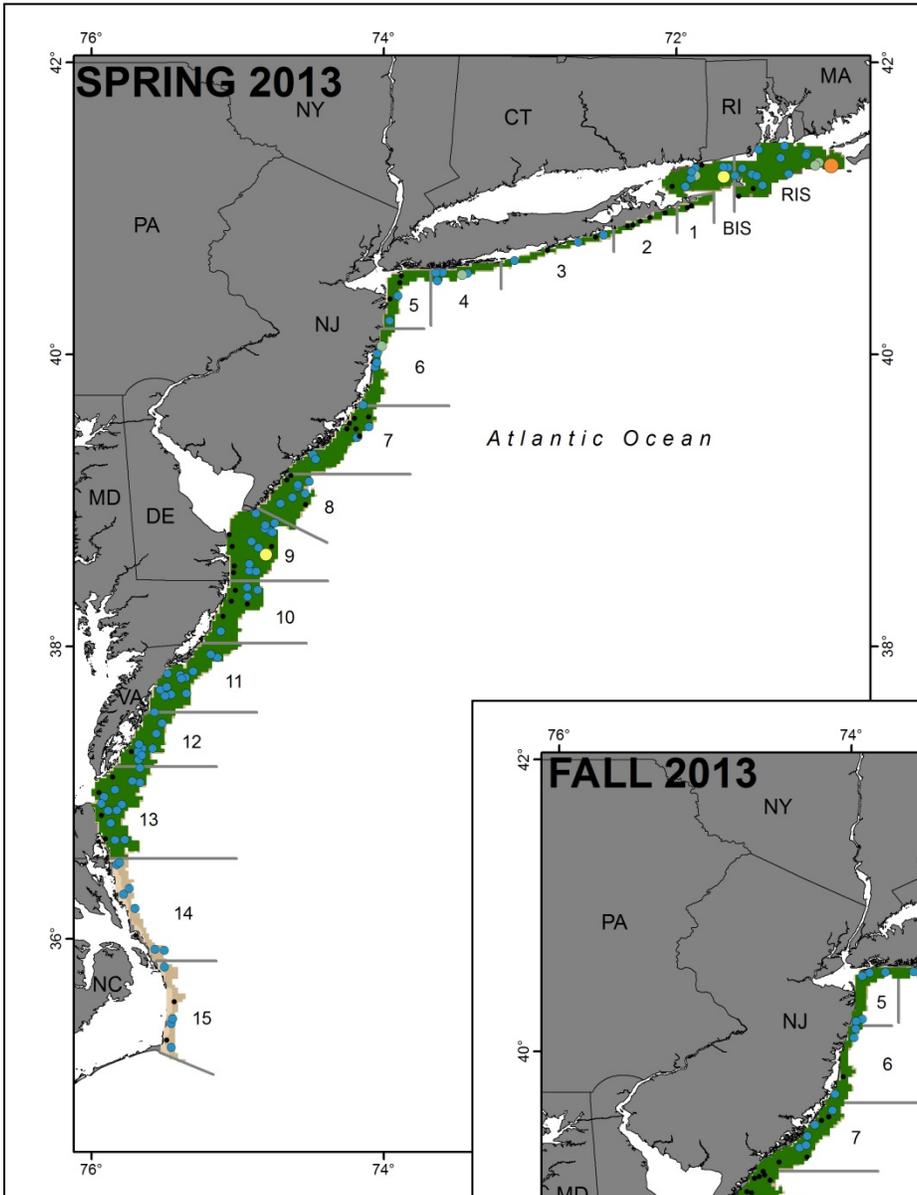
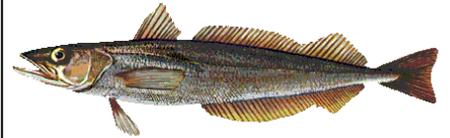
Figure 139. Scup diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Silver Hake (Whiting)

Sampling Priority: A

Figure 140. Silver Hake biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[Green]	[Green]
	BIS	90+		
NY	01	40-60	[Green]	[Green]
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40	[Green]	[Green]
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40	[Green]	[Green]
	09	40-60		
MD	10	20-40	[Green]	[Green]
	10	40-60		
	10	60-90		
VA	11	20-40	[Green]	[Green]
	12	40-60		
	12	60-90		
NC	14	20-40	[Green]	[Green]
	15	40-60		
	15	60-90		

[Green] = used for abundance indices
 [Grey] = not used for abundance indices

Table 48. Silver Hake sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	28,765	549.8	3,063	409	0	398	392
	2009	5,153	105.7	1,789	406	0	402	398
	2010	10,483	155.3	2,378	380	0	376	314
	2011	8,675	174.6	5,631	572	0	527	519
	2012	35,837	1,508.2	11,377	668	0	598	561
	2013	4,843	178.9	3,751	526	0	488	404
Fall	2007	346	24.8	346	59	0	59	59
	2008	3,125	183.9	515	96	0	88	87
	2009	1,470	17.3	499	125	0	122	116
	2010	440	18.2	409	124	0	122	119
	2011	1,057	35.8	503	135	0	130	107
	2012	328	18.4	263	96	0	66	62
	2013	568	5.6	568	140	0	75	0

Table 49. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	84	0.33	0.66	1.06	0.03	0.11	0.21
	2008	137	5.69	7.60	10.06	0.62	0.82	1.05	2008	89	0.42	0.85	1.43	0.00	0.16	0.35	
	2009	145	2.69	3.70	4.98	0.20	0.31	0.43	2009	96	0.51	0.93	1.46	0.00	0.08	0.16	
	2010	137	3.48	4.73	6.33	0.25	0.36	0.48	2010	89	0.64	1.02	1.48	0.07	0.14	0.22	
	2011	137	9.68	13.07	17.54	0.56	0.72	0.88	2011	89	0.88	1.31	1.85	0.15	0.25	0.35	
	2012	137	21.45	27.79	35.92	1.81	2.27	2.80	2012	89	0.36	0.65	1.01	0.04	0.12	0.21	
	2013	137	4.73	6.30	8.30	0.34	0.47	0.63	2013	89	0.74	1.06	1.42	0.03	0.05	0.06	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	84	0.13	0.30	0.49	0.00	0.01	0.02
	2008								2008	89	0.23	0.47	0.76	0.00	0.05	0.12	
	2009								2009	96	0.43	0.82	1.32	0.00	0.06	0.14	
	2010								2010	89	0.28	0.45	0.64	0.01	0.01	0.02	
	2011								2011	89	0.41	0.68	1.00	0.02	0.06	0.11	
	2012								2012	89	0.13	0.31	0.51	0.00	0.01	0.03	
	2013								2013	89	0.66	0.94	1.27	0.02	0.03	0.04	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007								1	2007	84	0.13	0.34	0.60	0.02	0.11	0.20
	2008	137	5.63	7.52	9.96	0.59	0.78	1.00	2008	89	0.11	0.43	0.83	0.00	0.15	0.32	
	2009	145	2.24	3.13	4.26	0.11	0.20	0.29	2009	96	0.02	0.15	0.29	0.00	0.04	0.09	
	2010	137	3.45	4.69	6.28	0.23	0.33	0.45	2010	89	0.22	0.46	0.76	0.06	0.13	0.21	
	2011	137	7.52	10.31	14.03	0.37	0.48	0.60	2011	89	0.36	0.63	0.95	0.11	0.19	0.29	
	2012	137	13.12	16.90	21.67	0.95	1.18	1.43	2012	89	0.22	0.46	0.75	0.03	0.11	0.20	
	2013	137	4.27	5.68	7.47	0.26	0.35	0.46	2013	89	0.03	0.12	0.21	0.00	0.02	0.03	
	2014								2014								
	2015								2015								
	2016								2016								
2+	2007																
	2008	137	0.25	0.42	0.61	0.10	0.18	0.28									
	2009	145	0.33	0.48	0.65	0.09	0.16	0.22									
	2010	137	0.04	0.12	0.21	0.01	0.05	0.08									
	2011	137	0.44	0.62	0.82	0.12	0.20	0.27									
	2012	137	1.60	2.08	2.65	0.65	0.86	1.09									
	2013	137	0.40	0.62	0.87	0.10	0.19	0.29									
	2014																
	2015																
	2016																

Figure 141. Silver Hake geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

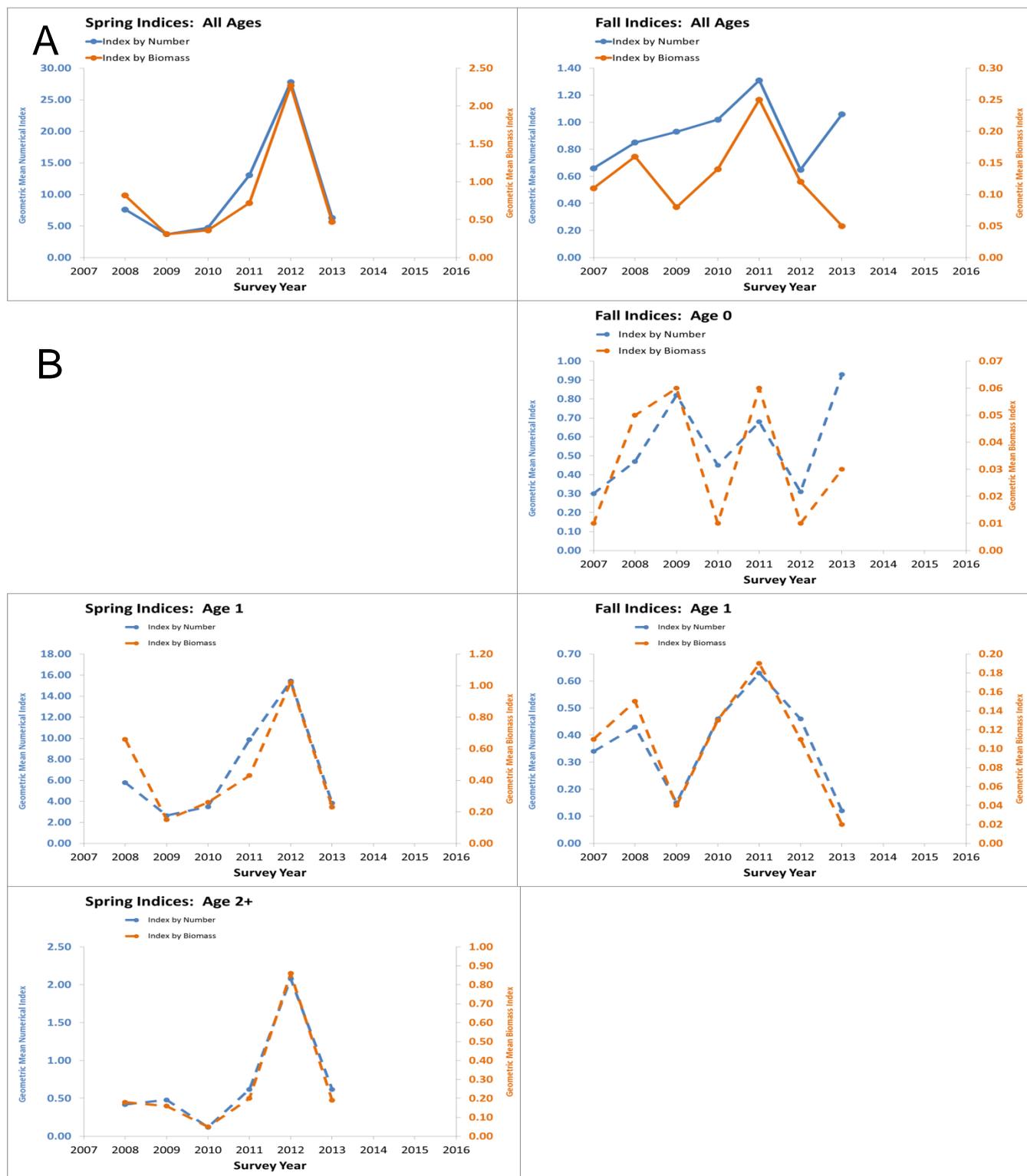


Figure 142. Silver Hake length-frequency distributions, by cruise (Blue reference lines are placed at the size cutoff values used to separate recruits from older specimens. Cutoff values - spring 20cm, fall 17cm - estimated by examination of these length frequency figures.)

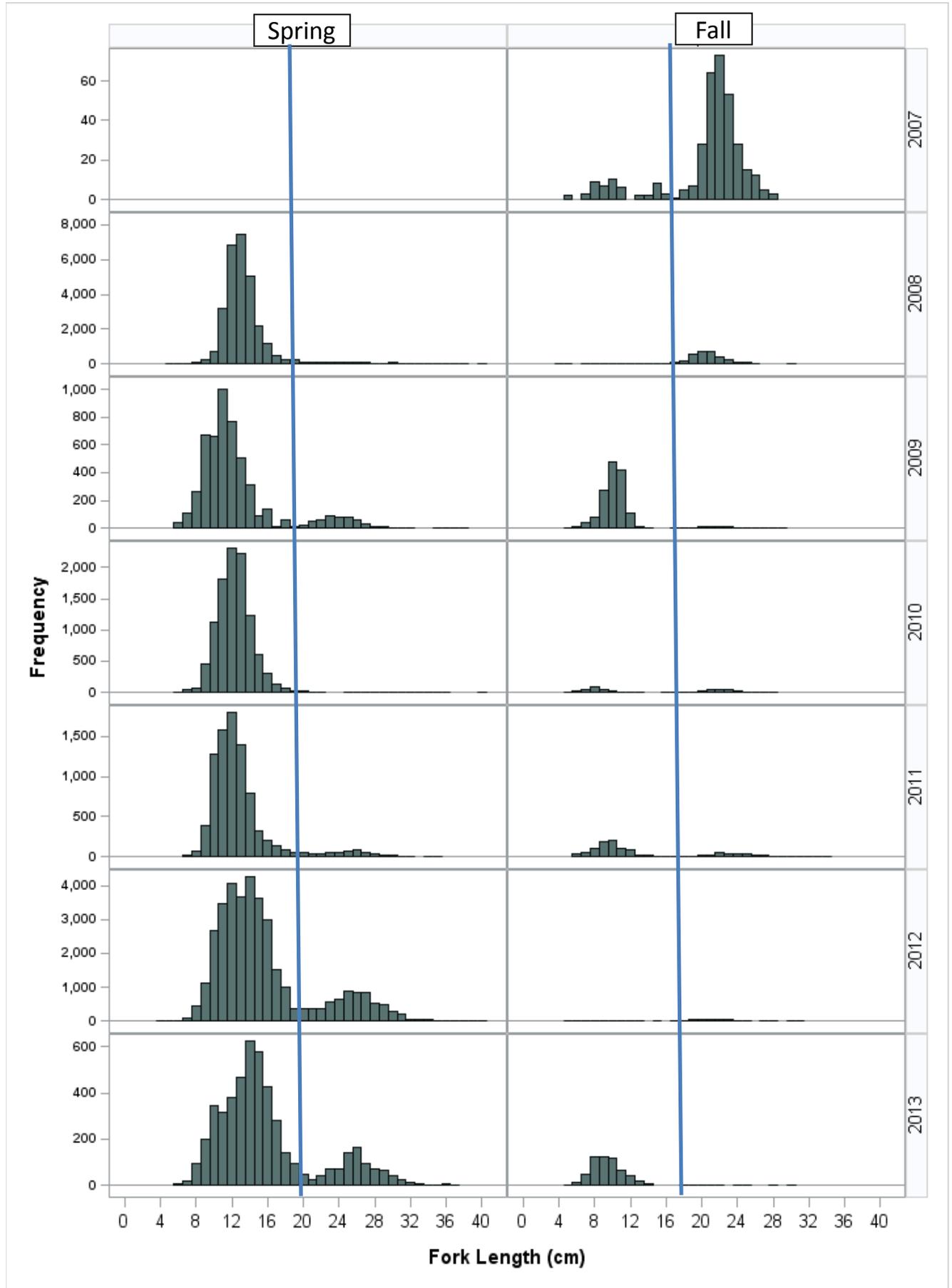


Figure 143. Silver Hake sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

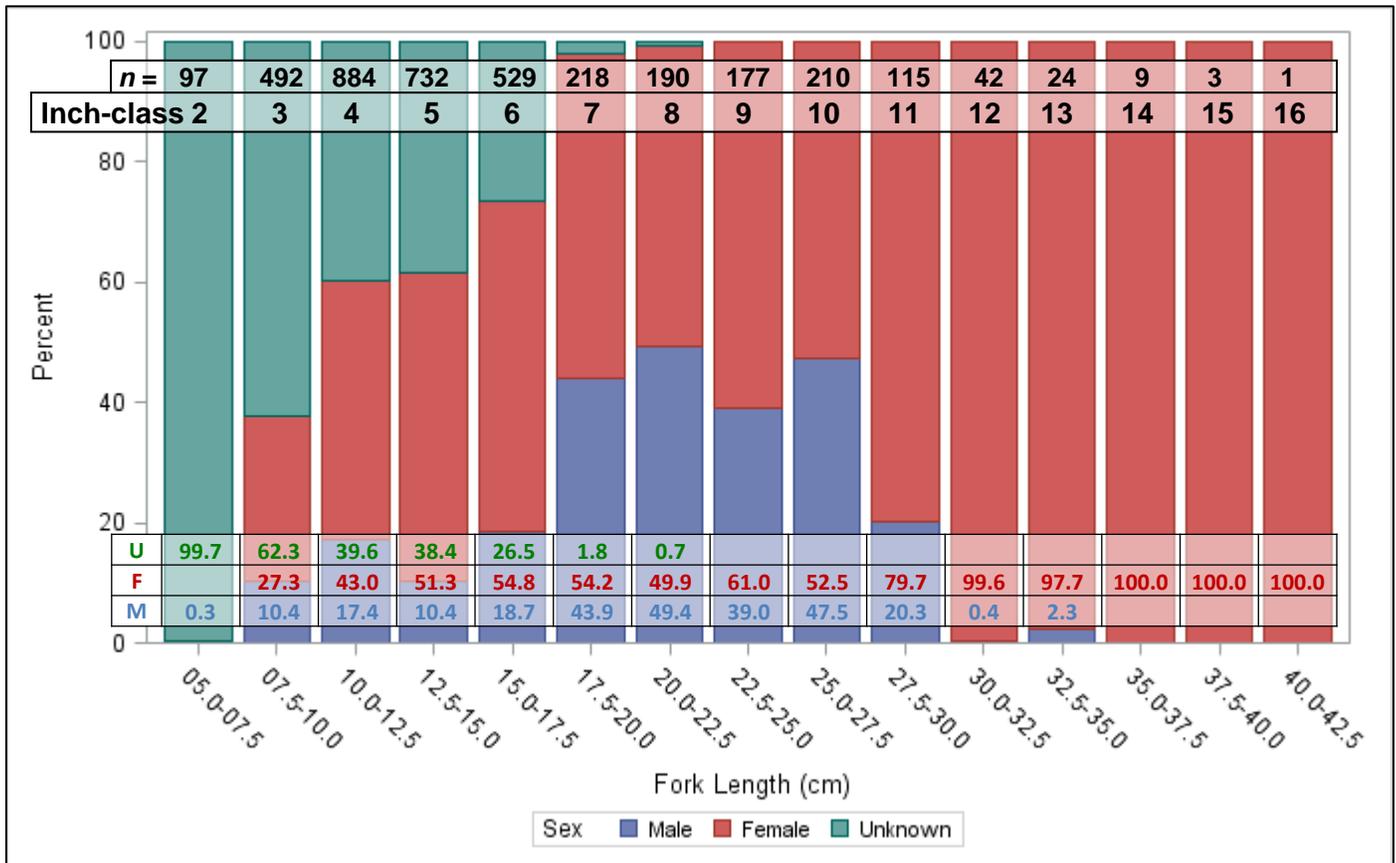


Figure 144. Silver Hake maturity at length, by sex for all cruises pooled, 2007-2013.

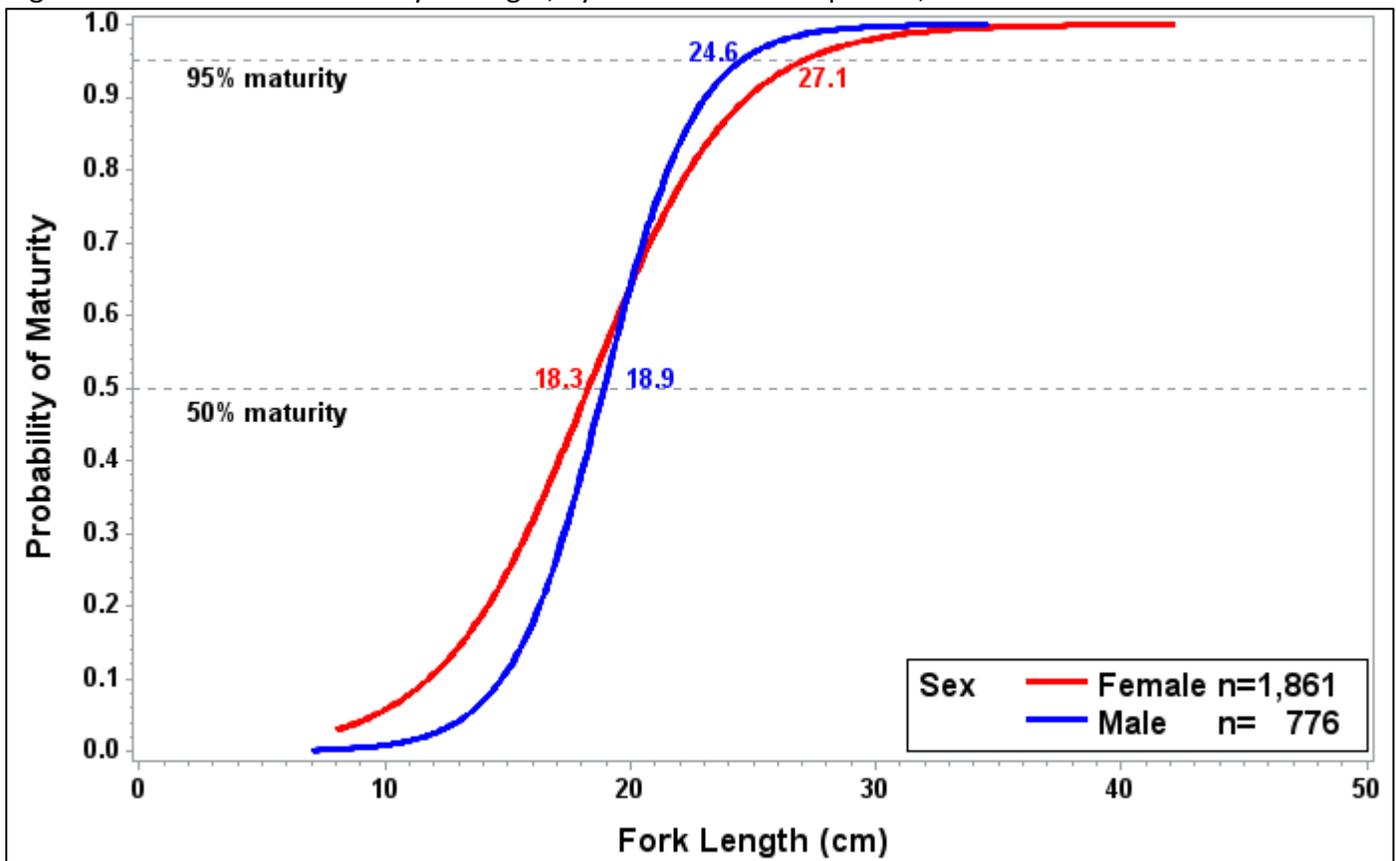
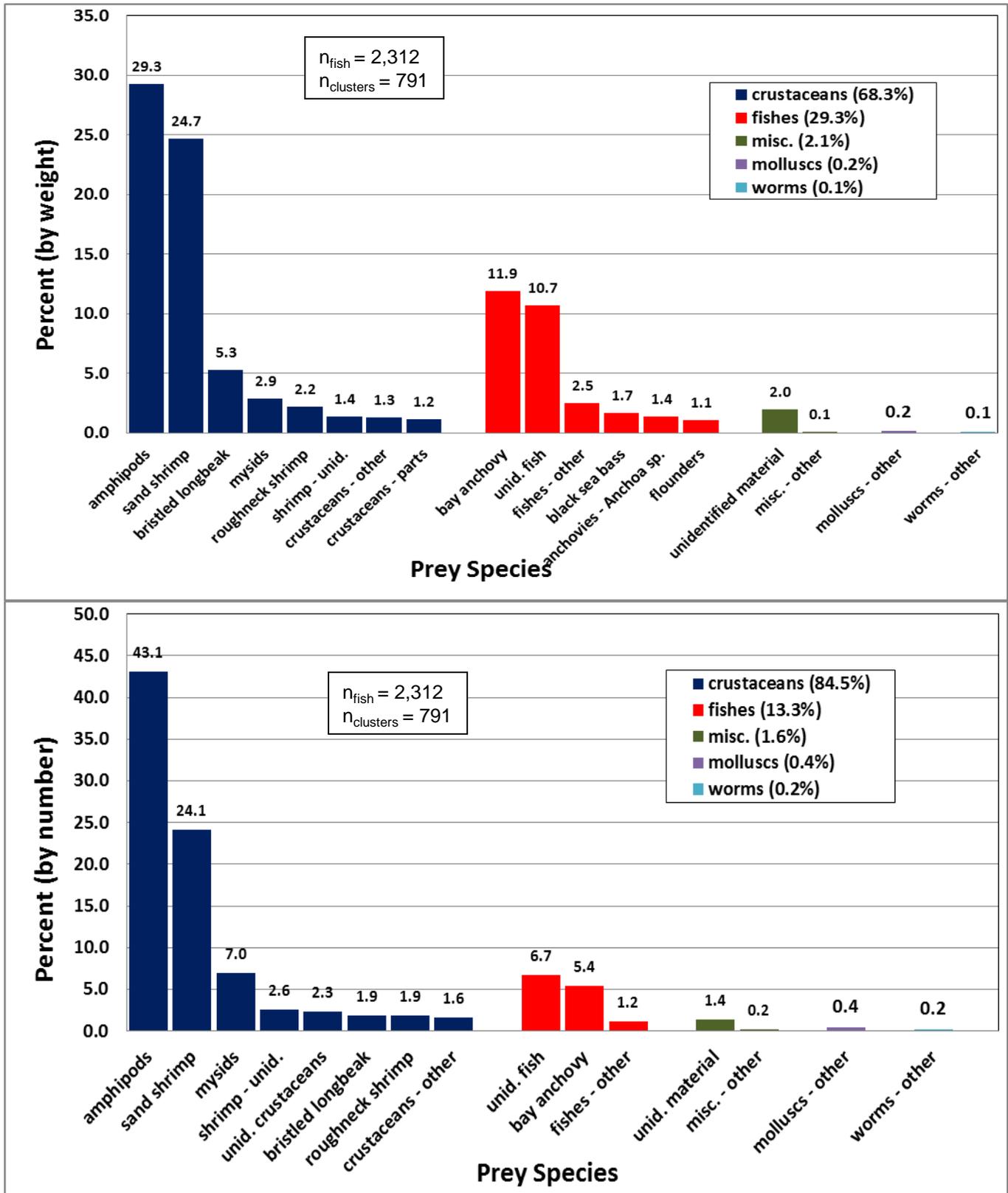


Figure 145. Silver Hake diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)

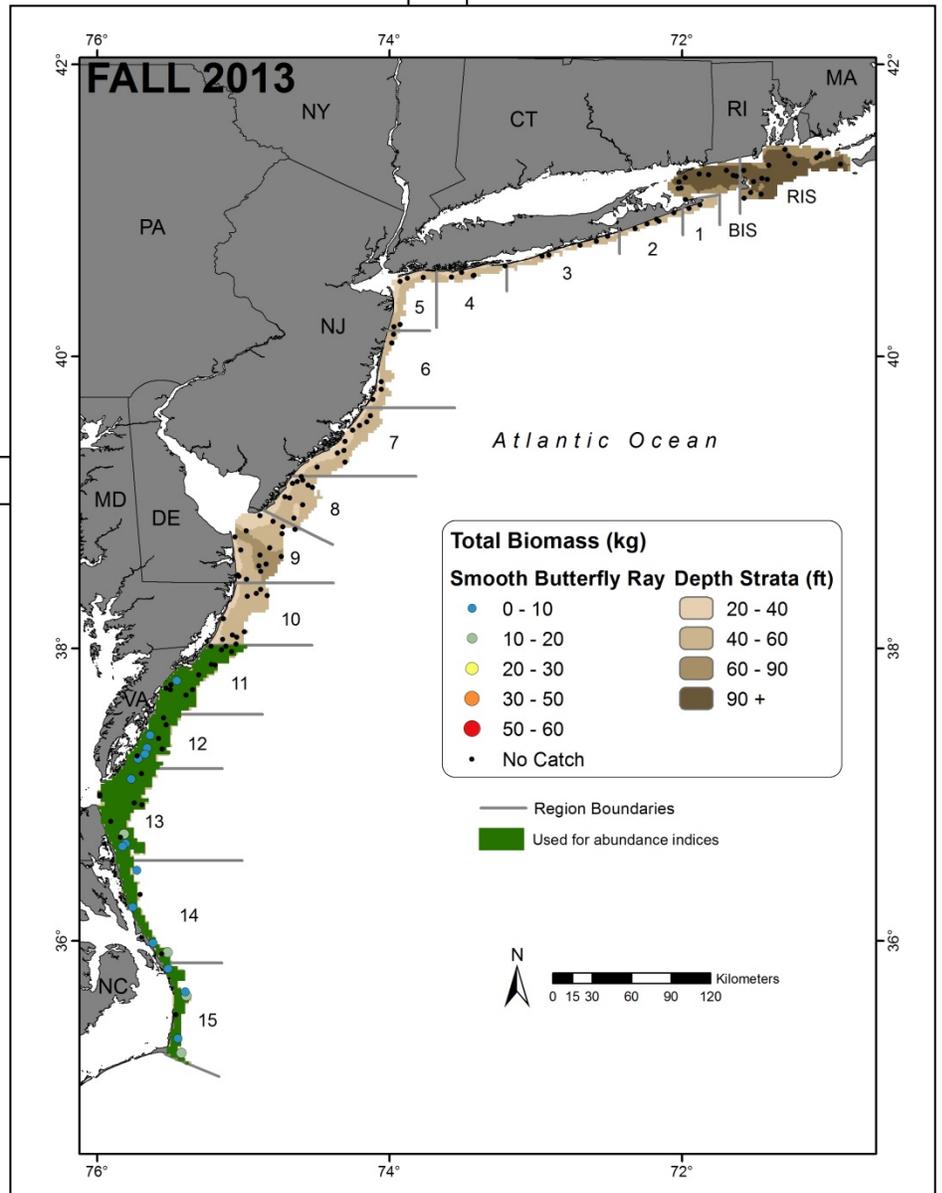
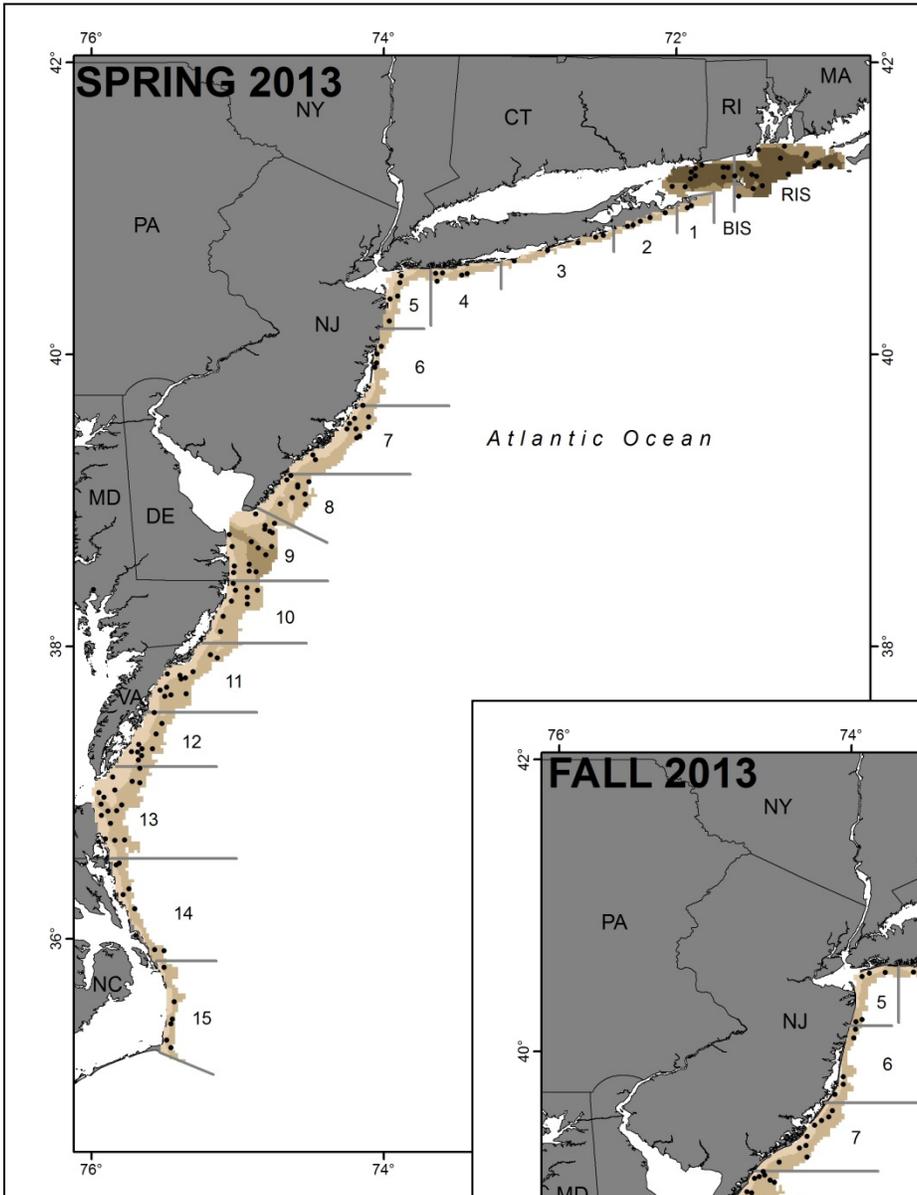


Smooth Butterfly Ray

Ray

Sampling Priority: E

Figure 146. Smooth Butterfly Ray biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	60-90		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 50. Smooth Butterfly Ray sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0	N/A	N/A	N/A	N/A
	2009	2	4.5	2	N/A	N/A	N/A	N/A
	2010	3	4.7	3	N/A	N/A	N/A	N/A
	2011	1	6.9	1	N/A	N/A	N/A	N/A
	2012	16	31.8	16	14	0	0	0
	2013	0	0.0	0	0	0	0	0
Fall	2007	292	557.1	292	N/A	N/A	N/A	N/A
	2008	227	346.6	195	N/A	N/A	N/A	N/A
	2009	61	132.2	61	N/A	N/A	N/A	N/A
	2010	182	581.4	171	N/A	N/A	N/A	N/A
	2011	77	154.9	77	N/A	N/A	N/A	N/A
	2012	143	264.8	143	51	0	2	0
	2013	57	108.2	57	6	0	0	0

Table 51. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	56	0.86	1.44	2.20	1.47	2.57	4.17
	2008	51	1.45	2.22	3.23	1.80	2.88	4.37
	2009	53	0.28	0.49	0.73	0.27	0.54	0.88
	2010	51	0.90	1.31	1.81	1.22	2.03	3.13
	2011	51	0.55	0.84	1.19	0.75	1.31	2.03
	2012	51	1.06	1.60	2.28	1.44	2.28	3.42
	2013	51	0.47	0.71	0.99	0.61	0.98	1.44
	2014							
	2015							
	2016							

Figure 147. Smooth Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

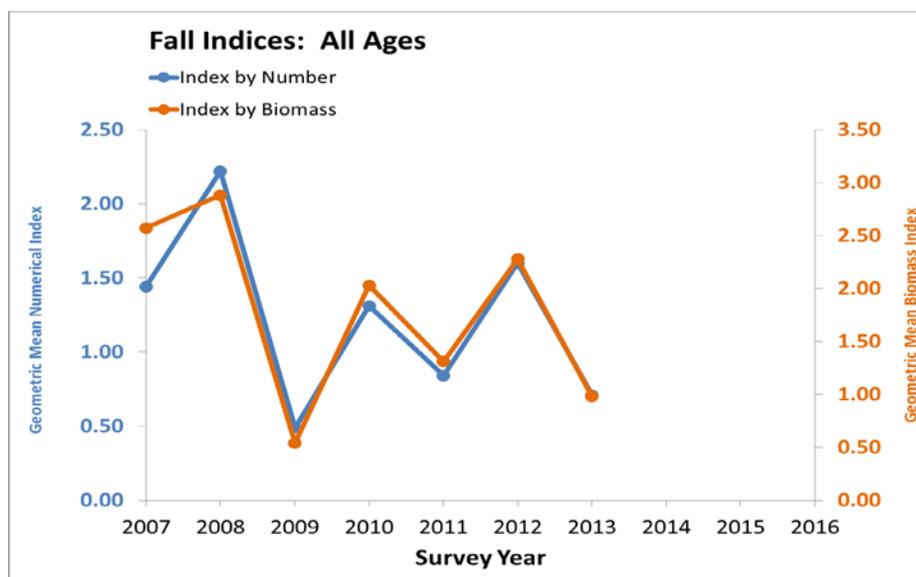


Figure 148. Smooth Butterfly Ray length-frequency distributions, by cruise.

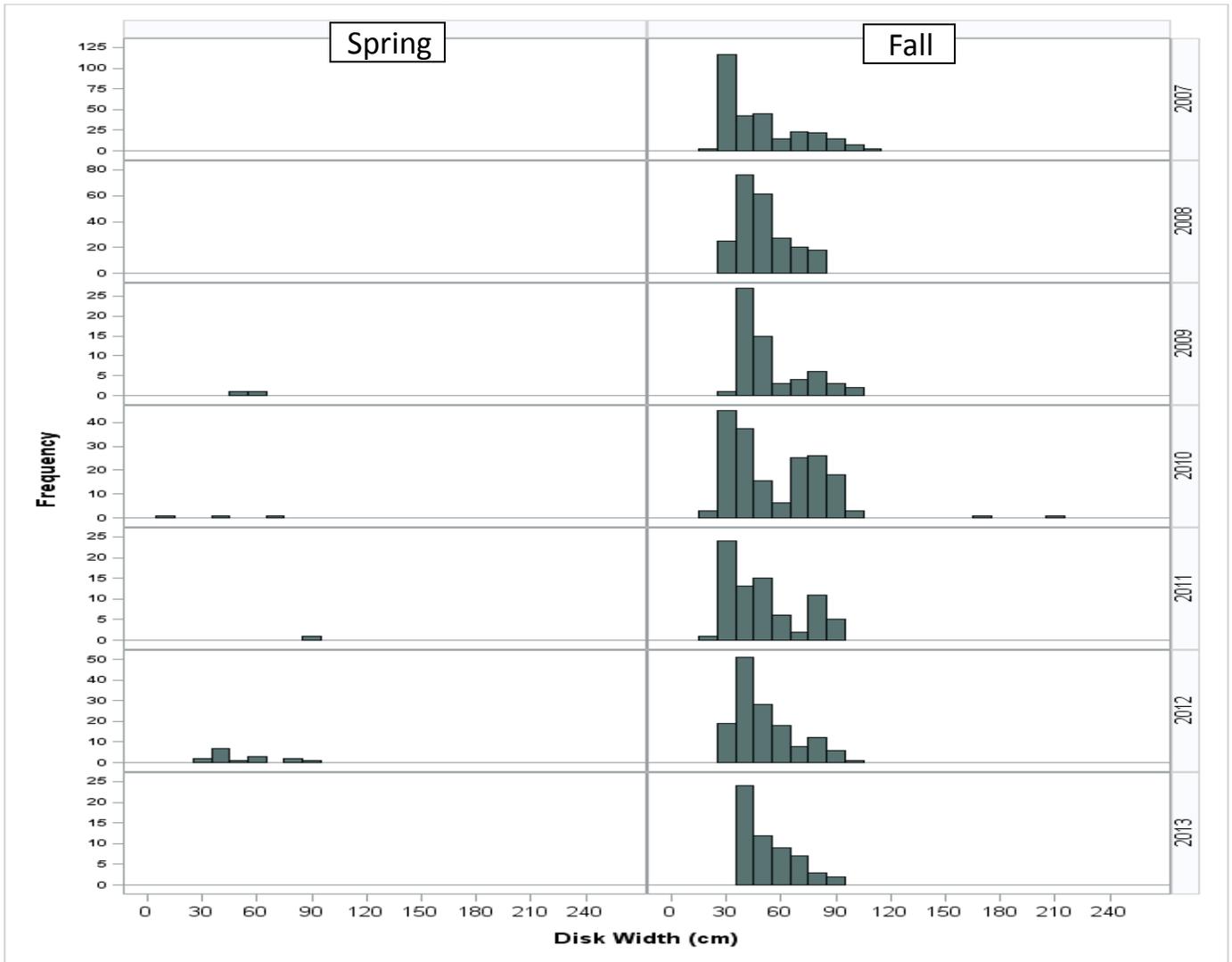
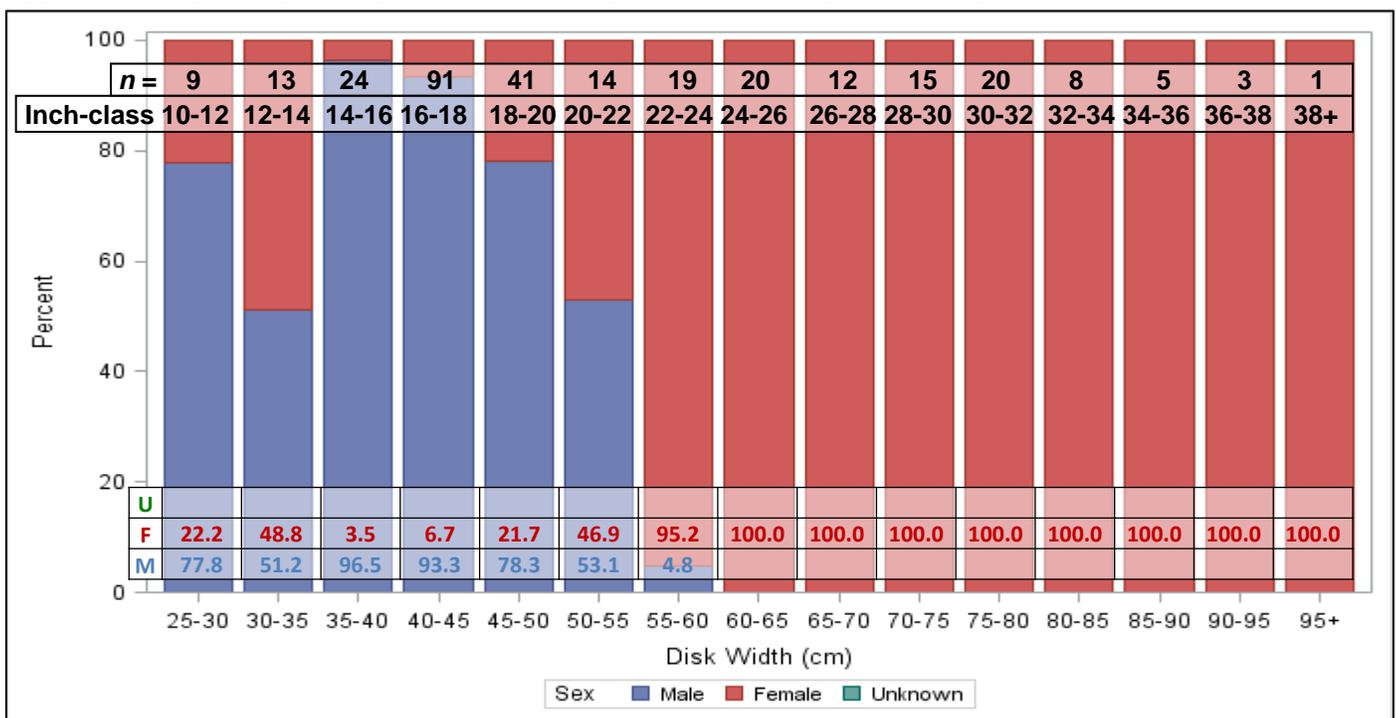


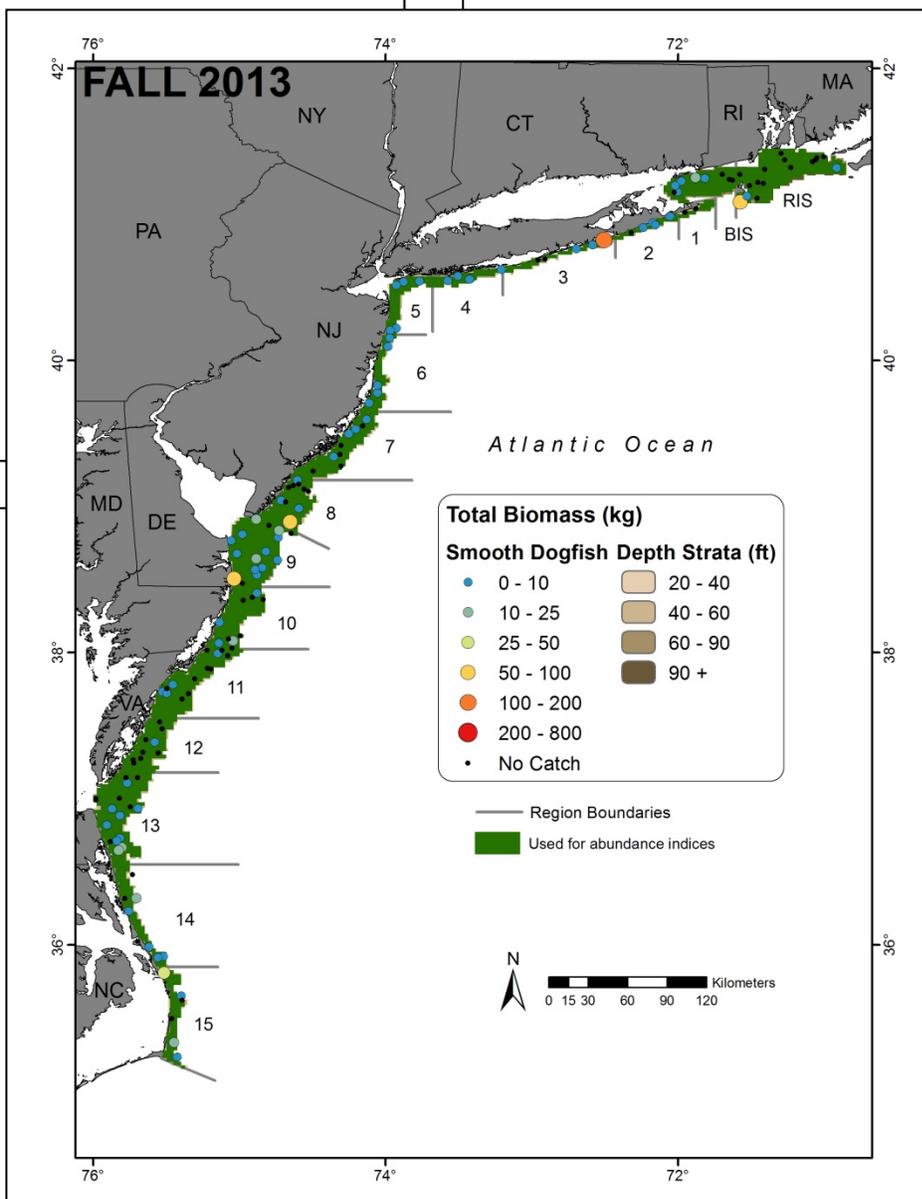
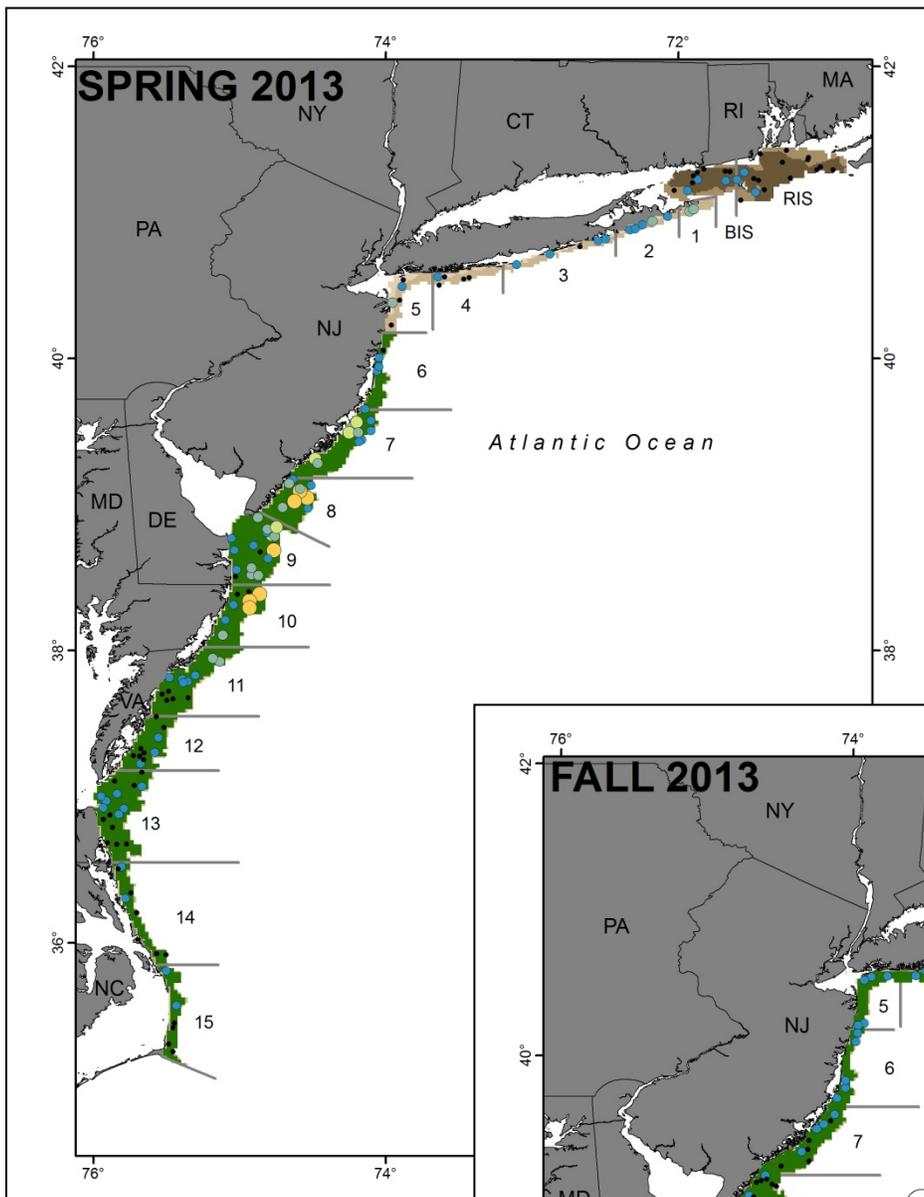
Figure 149. Smooth Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)



Smooth Dogfish Sampling Priority: A

Figure 150. Smooth Dogfish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	60-90		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
VA	11	20-40		
		40-60		
		40-60		
NC	12	20-40		
	13	20-40		
	15	20-40		
		40-60		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 52. Smooth Dogfish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	927	2,501.7	688	297	0	288	286
	2009	947	2,741.4	725	236	0	221	216
	2010	402	1,232.6	399	188	0	181	174
	2011	521	1,741.5	458	186	0	169	165
	2012	189	627.3	189	138	0	130	121
	2013	411	1,236.1	411	176	0	165	153
Fall	2007	1,684	1,548.7	759	196	0	194	192
	2008	414	365.4	386	162	0	161	161
	2009	1,178	856.9	1,178	333	0	330	323
	2010	758	691.1	602	223	0	215	215
	2011	606	616.9	606	205	0	200	198
	2012	783	947.4	783	161	0	152	143
	2013	549	770.3	459	174	0	170	0

Table 53. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and for the youngest year class captured (fall only).

Spring Survey							Fall Survey												
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index				
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI		
All	2007																		
	2008	101	4.85	5.96	7.27	11.82	14.80	18.48				1.46	1.93	2.50	1.30	1.73	2.24		
	2009	107	3.12	3.97	5.00	6.97	9.22	12.11				0.80	1.08	1.40	0.70	0.96	1.26		
	2010	102	1.86	2.36	2.96	4.54	5.94	7.69				2.80	3.37	4.03	2.17	2.69	3.28		
	2011	102	1.54	1.89	2.30	3.58	4.54	5.69				1.49	1.85	2.26	1.18	1.51	1.89		
	2012	102	0.63	0.82	1.03	1.17	1.61	2.14				1.33	1.60	1.90	1.16	1.46	1.81		
	2013	103	1.28	1.63	2.04	2.76	3.65	4.77				0.98	1.27	1.59	1.20	1.54	1.93		
	2014											0.80	1.06	1.35	0.92	1.26	1.67		
	2015																		
	2016																		
0	2007	150										0.85	1.16	1.51	0.57	0.78	1.02		
	2008	150										0.45	0.65	0.87	0.23	0.34	0.46		
	2009	160										2.12	2.55	3.03	1.23	1.47	1.74		
	2010	150										1.09	1.35	1.65	0.65	0.81	0.99		
	2011	150										0.88	1.08	1.31	0.54	0.67	0.82		
	2012	150										0.48	0.69	0.92	0.31	0.46	0.63		
	2013	150										0.36	0.53	0.71	0.21	0.32	0.43		
	2014																		
	2015																		
	2016																		

Figure 151. Smooth Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured (A) and for the youngest year class captured (B).

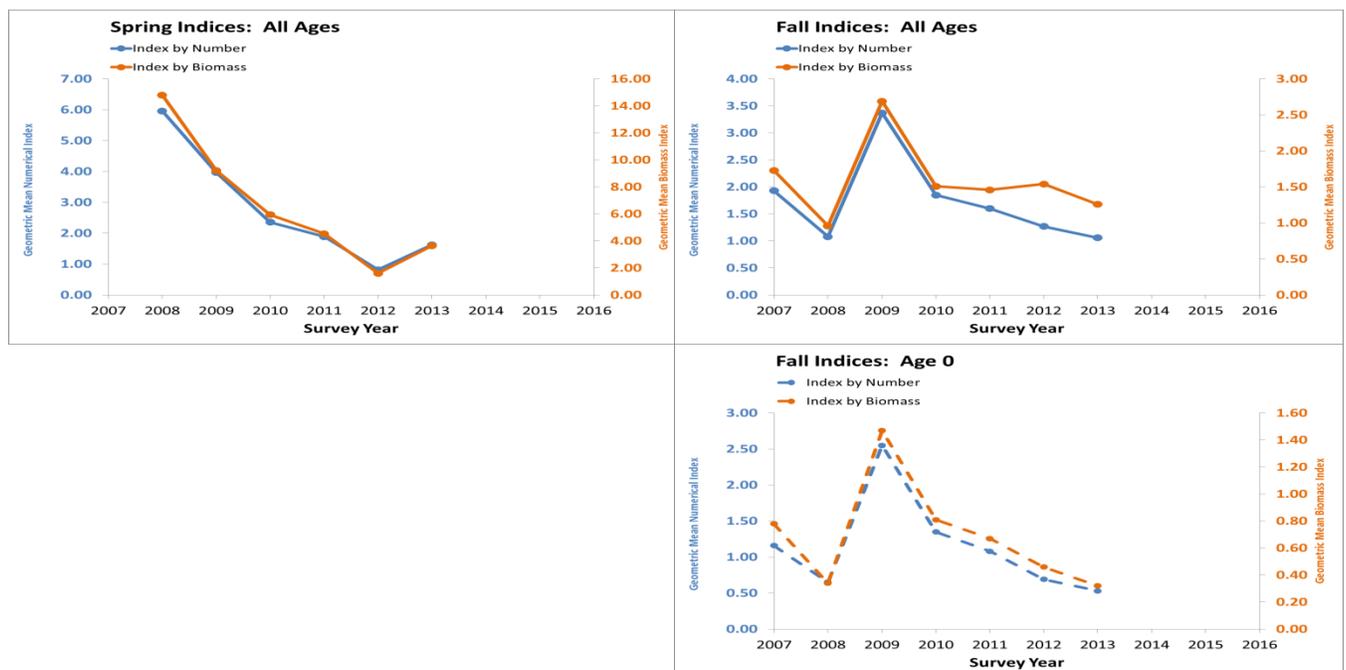


Figure 152. Smooth Dogfish length-frequency distributions, by cruise (Blue reference line is placed at the size cutoff value used to separate recruits from older specimens. Cutoff value - fall 47cm - estimated by examination of these length frequency figures and from Conrath et al., (2002)).

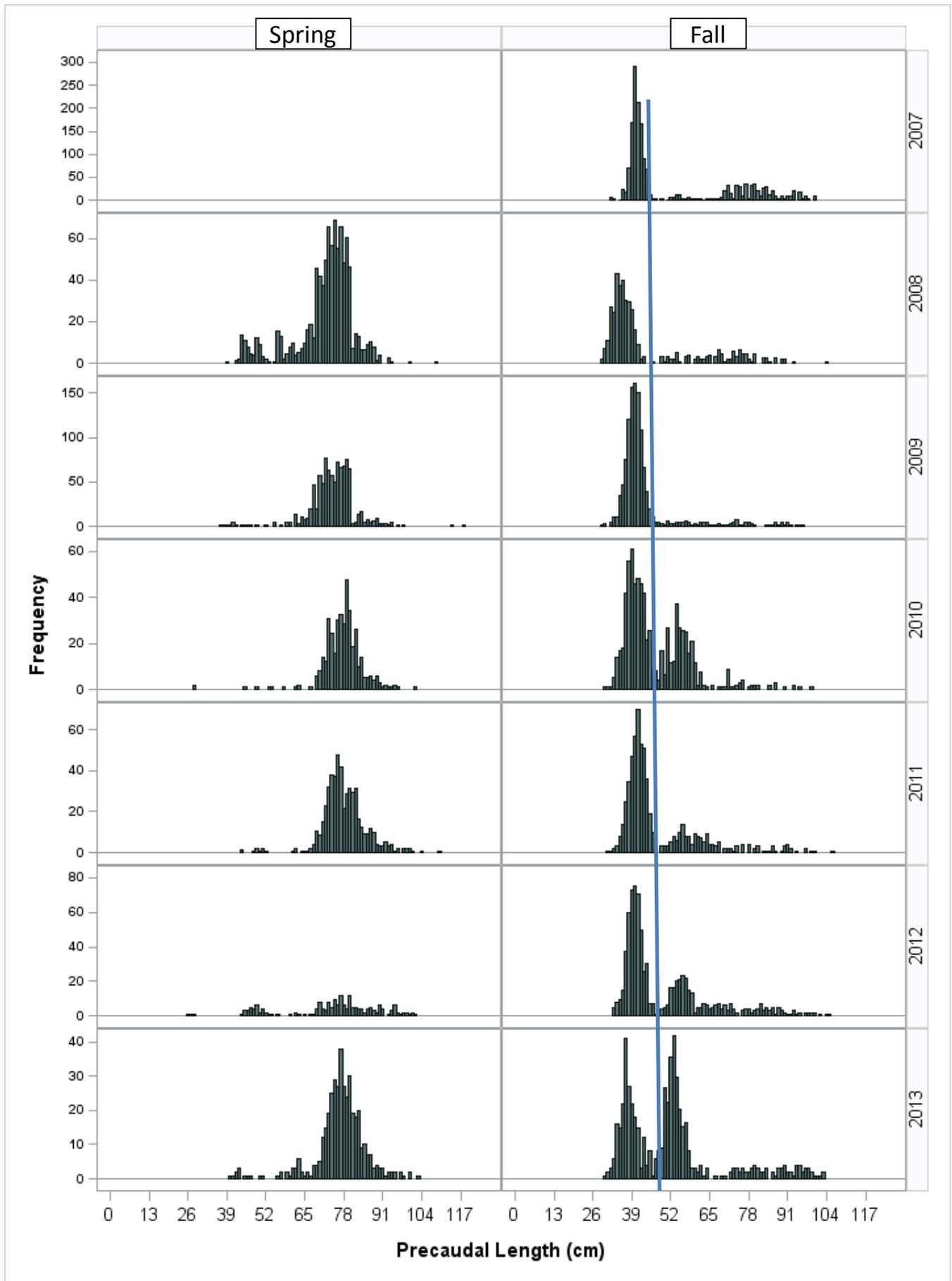


Figure 153. Smooth Dogfish length-frequency distributions, by cruise and sex.

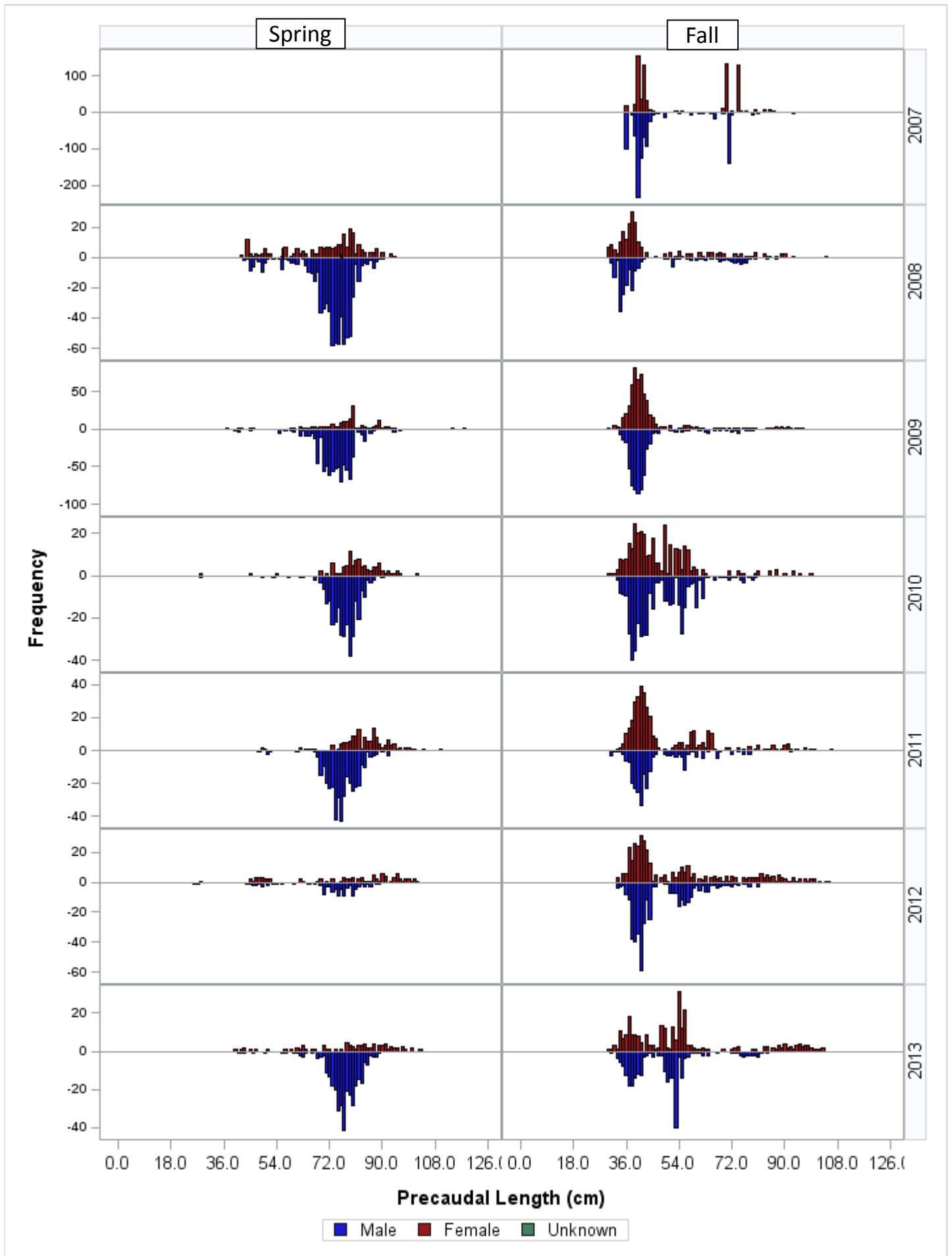


Figure 154. Smooth Dogfish sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

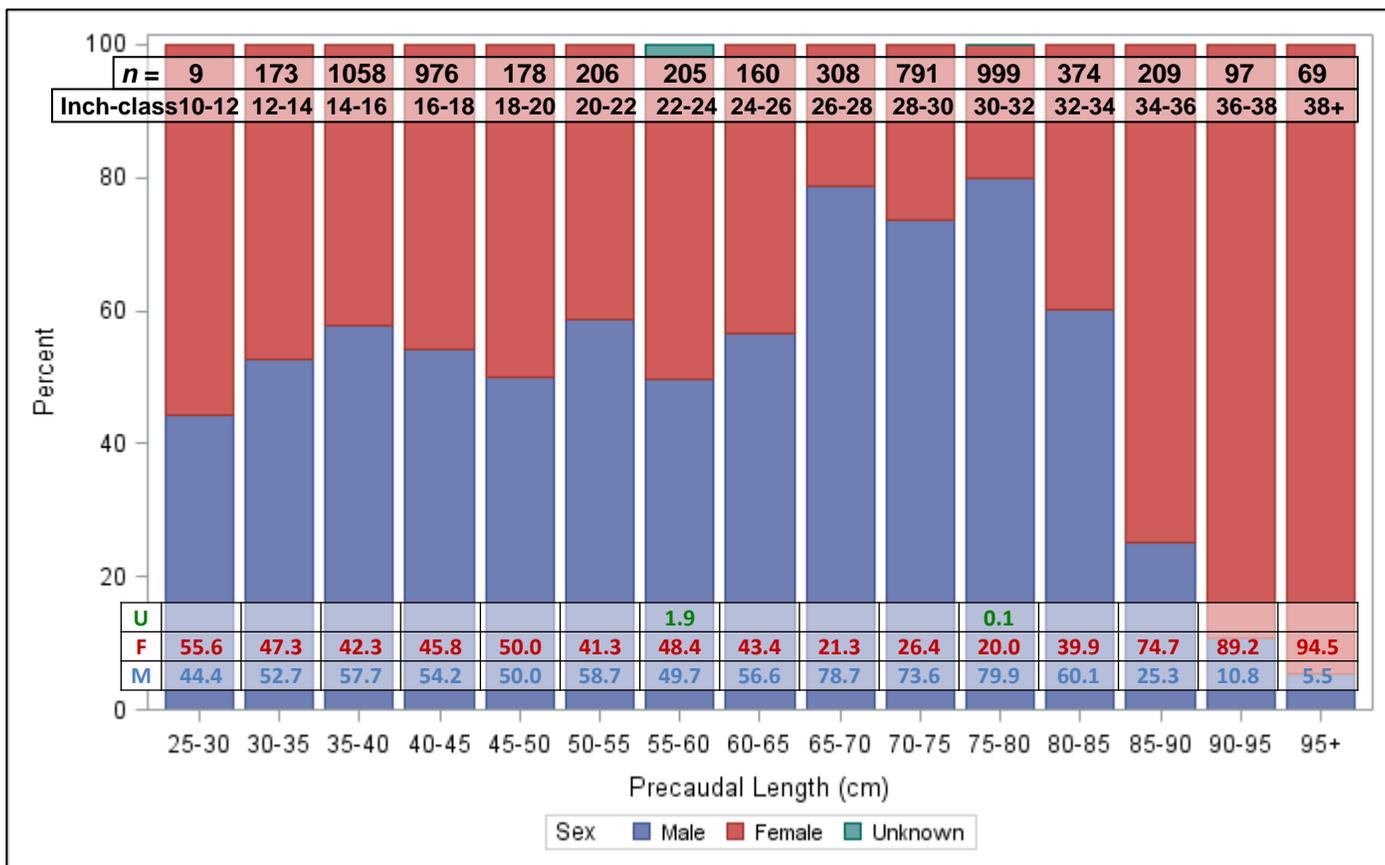


Figure 155. Smooth Dogfish maturity at length, by sex for all cruises pooled, 2007-2013.

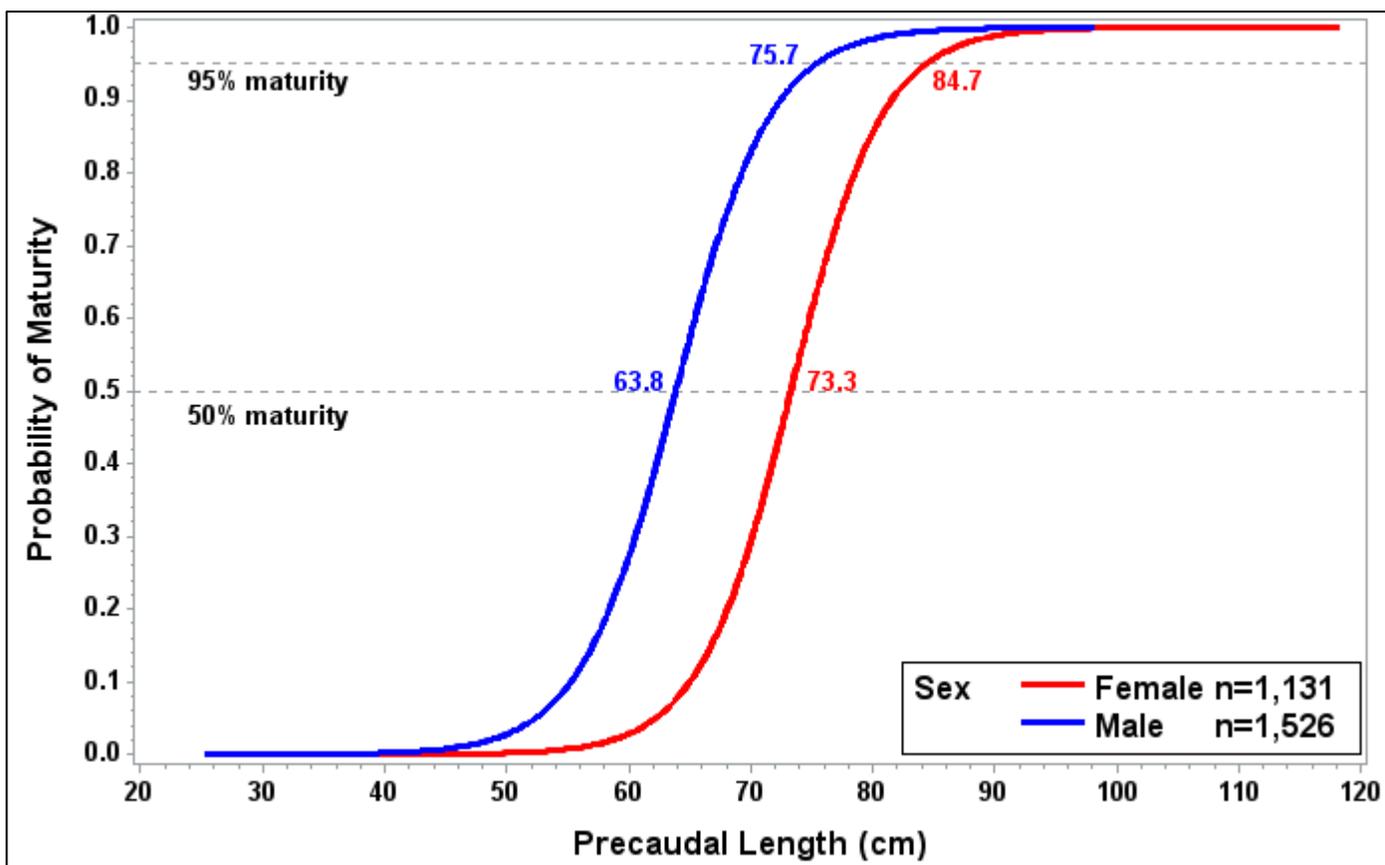


Figure 156. Smooth Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)

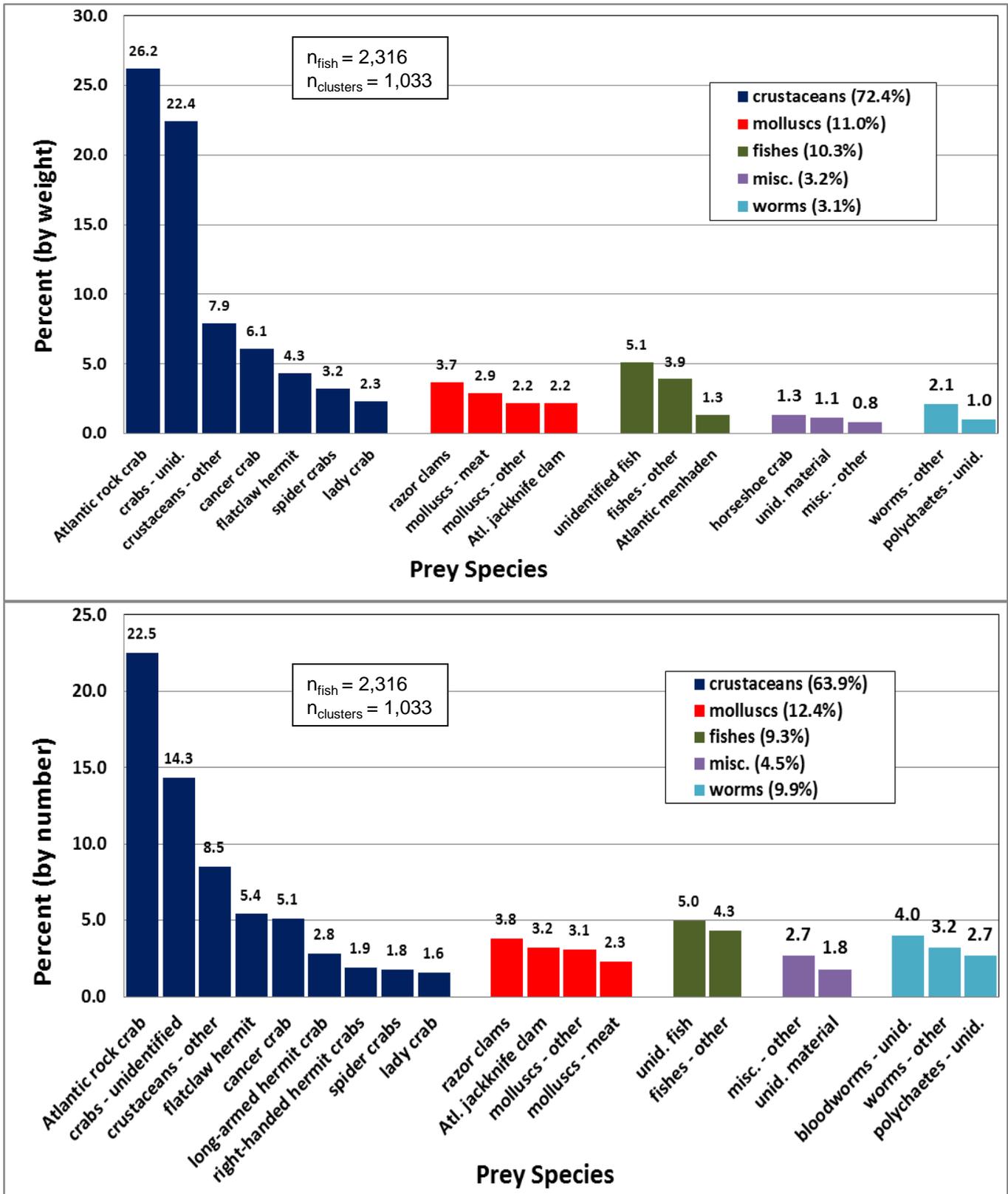
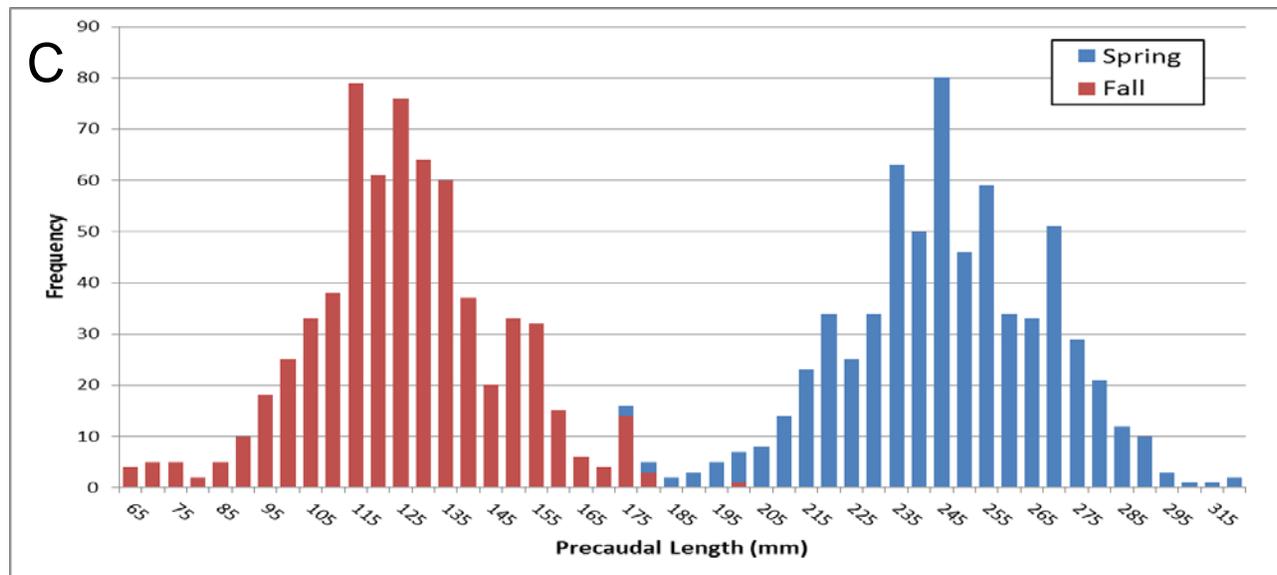
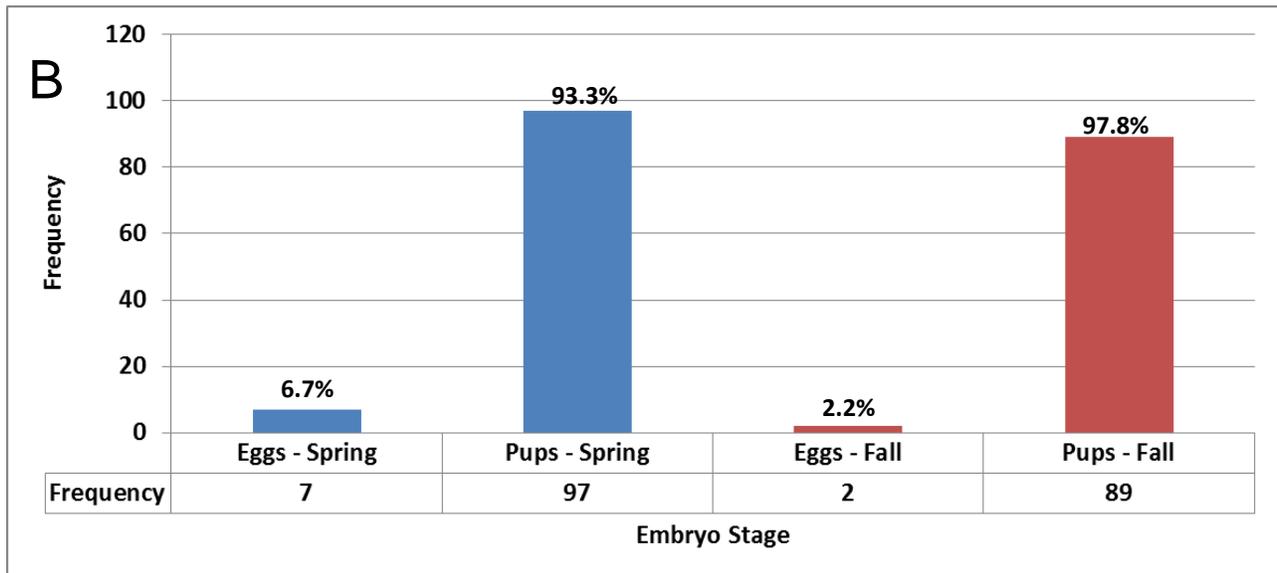
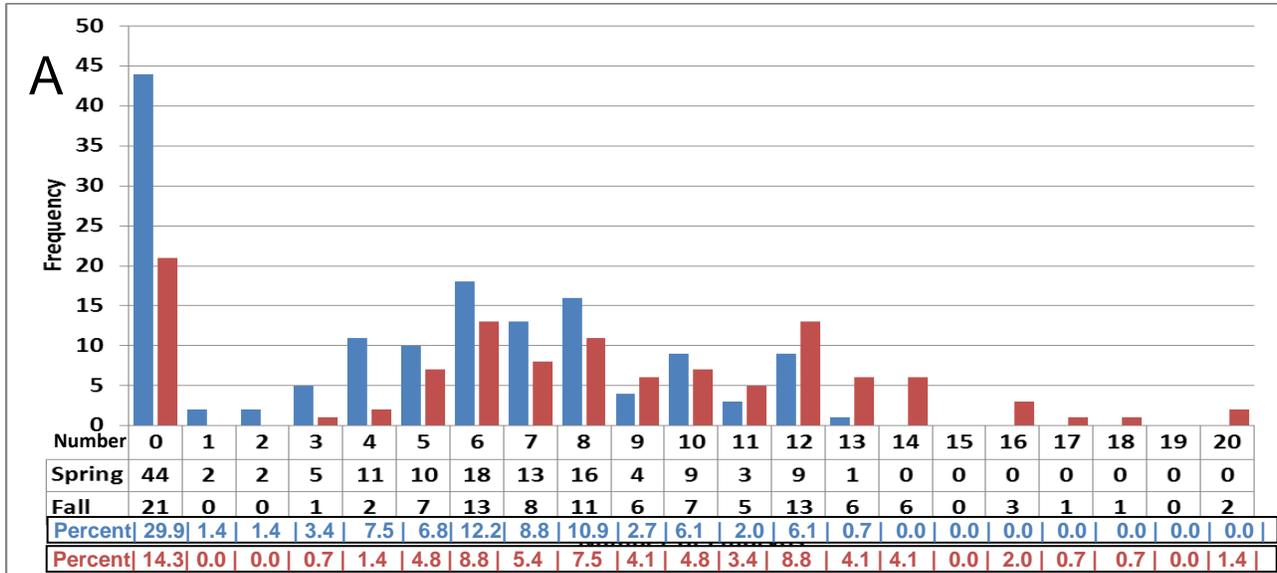
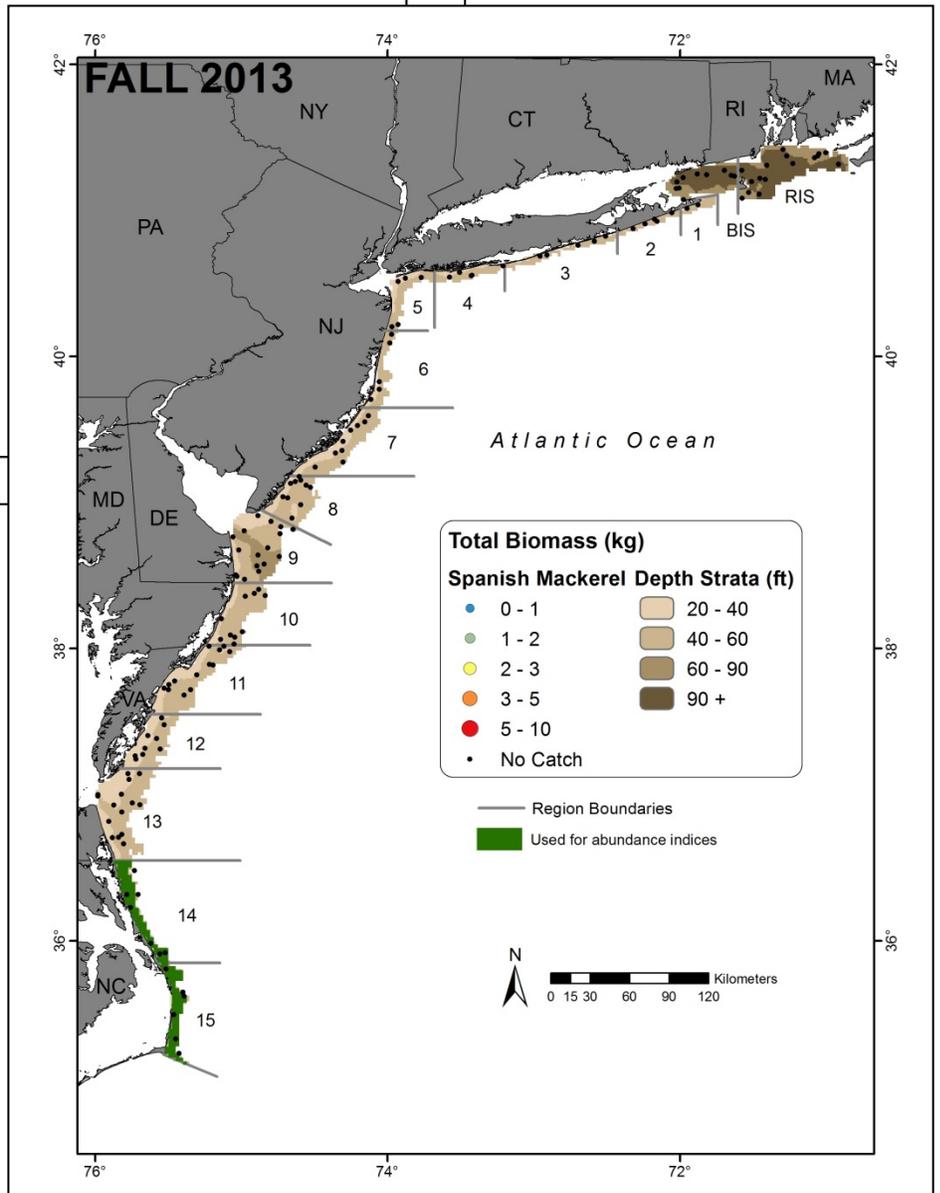
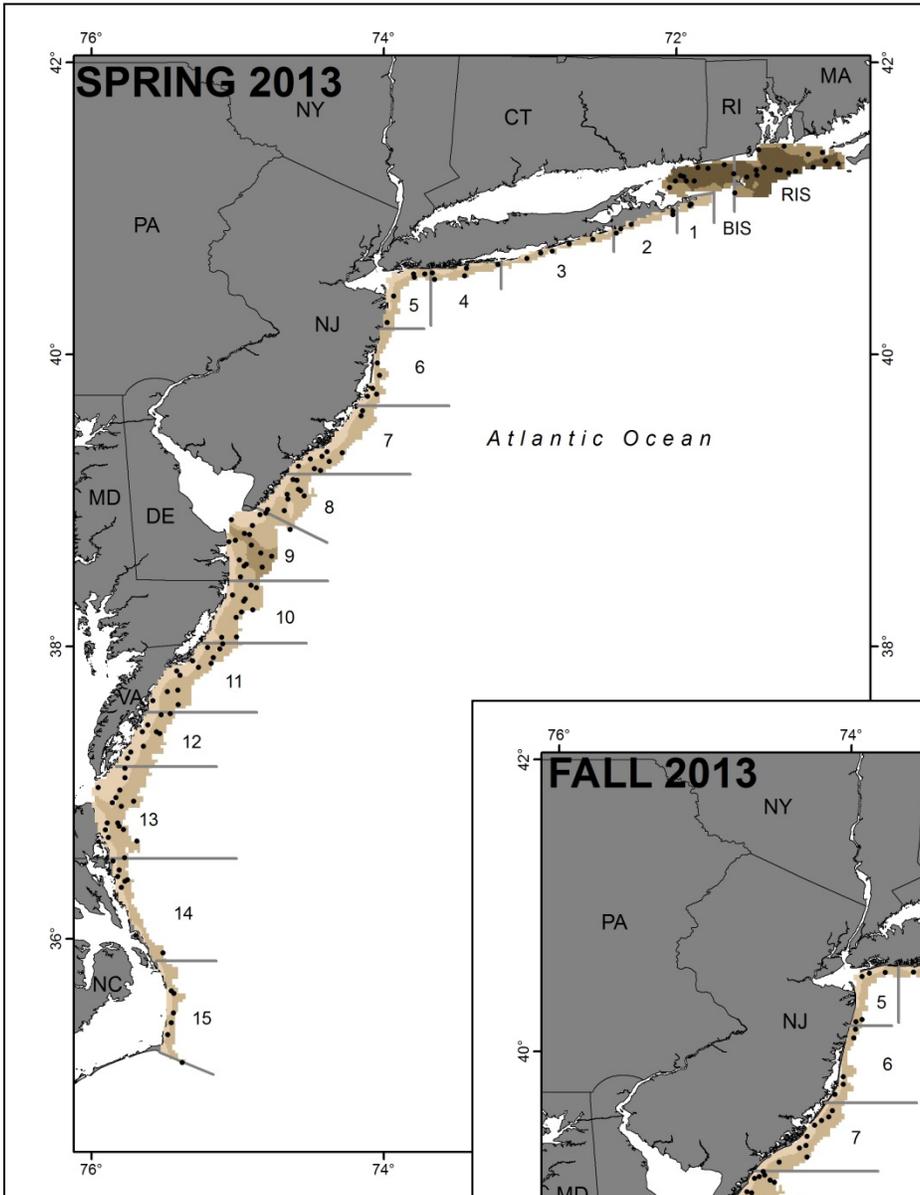


Figure 157. Smooth Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.



Spanish Mackerel Sampling Priority: A

Figure 158. Spanish Mackerel biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
MD	10	20-40		
	10	40-60		
VA	11	20-40		
	11	40-60		
	11	40-60		
NC	14	20-40		
	14	40-60		
NC	15	20-40		
	15	40-60		

= used for abundance indices
 = not used for abundance indices

Table 54. Spanish Mackerel sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0	0	0	0	0
	2009	0	0.0	0	0	0	0	0
	2010	0	0.0	0	0	0	0	0
	2011	0	0.0	0	0	0	0	0
	2012	0	0.0	0	0	0	0	0
2013	0	0.0	0	0	0	0	0	
Fall	2007	161	42.5	161	0	0	0	0
	2008	14	2.0	14	0	0	0	0
	2009	31	3.9	31	12	0	10	10
	2010	141	9.6	141	17	0	17	17
	2011	9	0.6	9	6	0	5	0
	2012	17	3.1	17	1	0	1	1
	2013	1	0.1	1	1	0	1	0

Table 55. Spanish Mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Fall Survey								
Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	13	0.45	1.40	2.96	0.23	0.60	1.08
	2008	13	0.00	0.29	1.14	0.00	0.11	0.35
	2009	15	0.00	0.33	1.02	0.00	0.10	0.26
	2010	13	0.07	1.43	4.51	0.00	0.32	0.99
	2011	13	0.00	0.21	0.78	0.00	0.03	0.11
	2012	13	0.00	0.23	0.68	0.00	0.09	0.24
	2013	13	0.00	0.00	0.00	0.00	0.00	0.00
	2014							
	2015							
	2016							

Figure 159. Spanish Mackerel geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

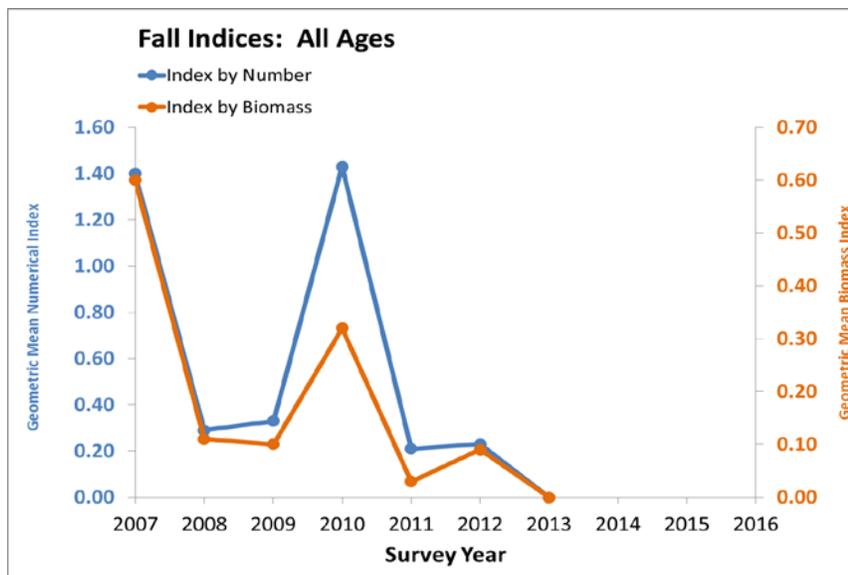


Figure 160. Spanish Mackerel length-frequency distributions, by cruise .

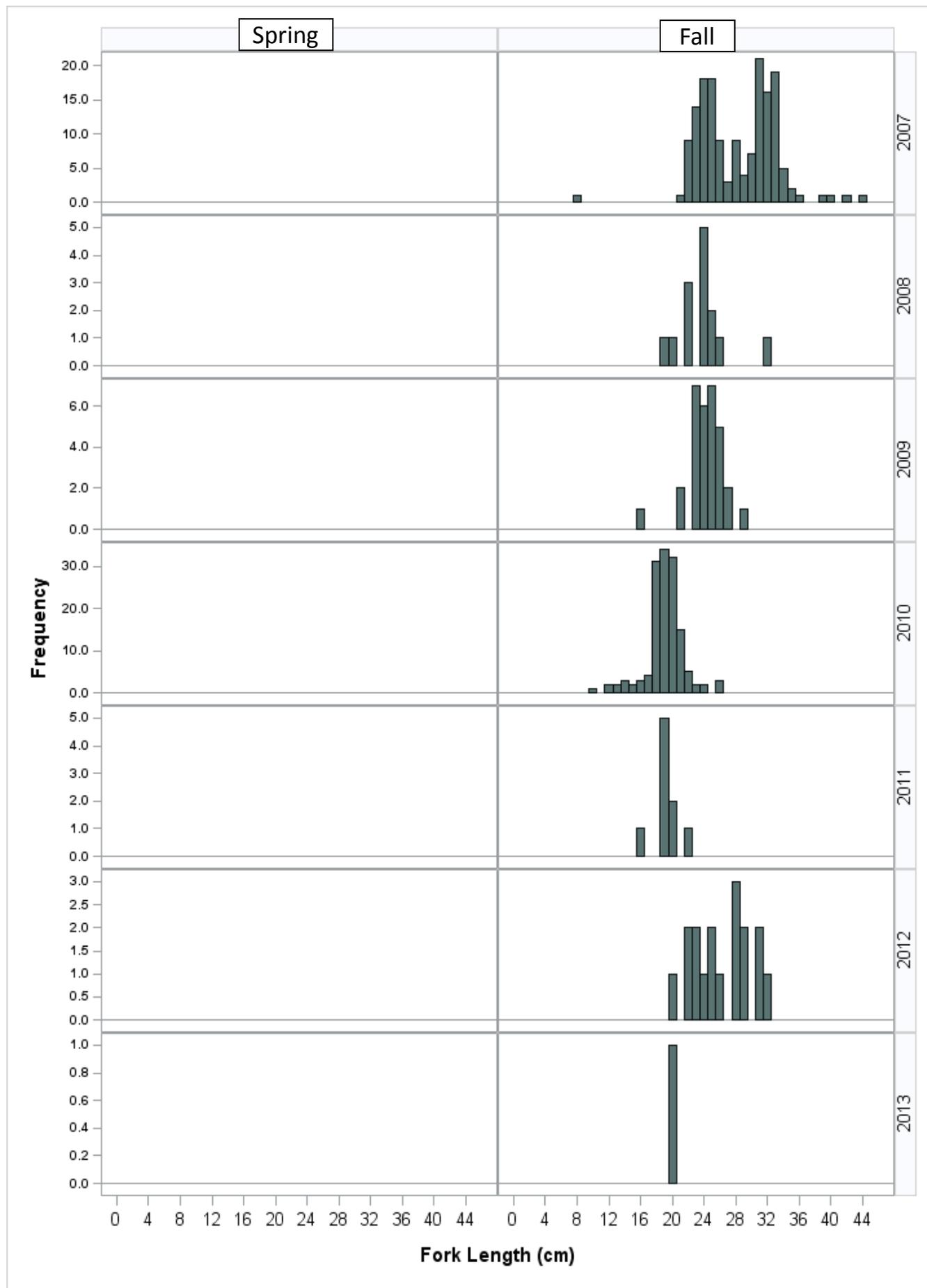
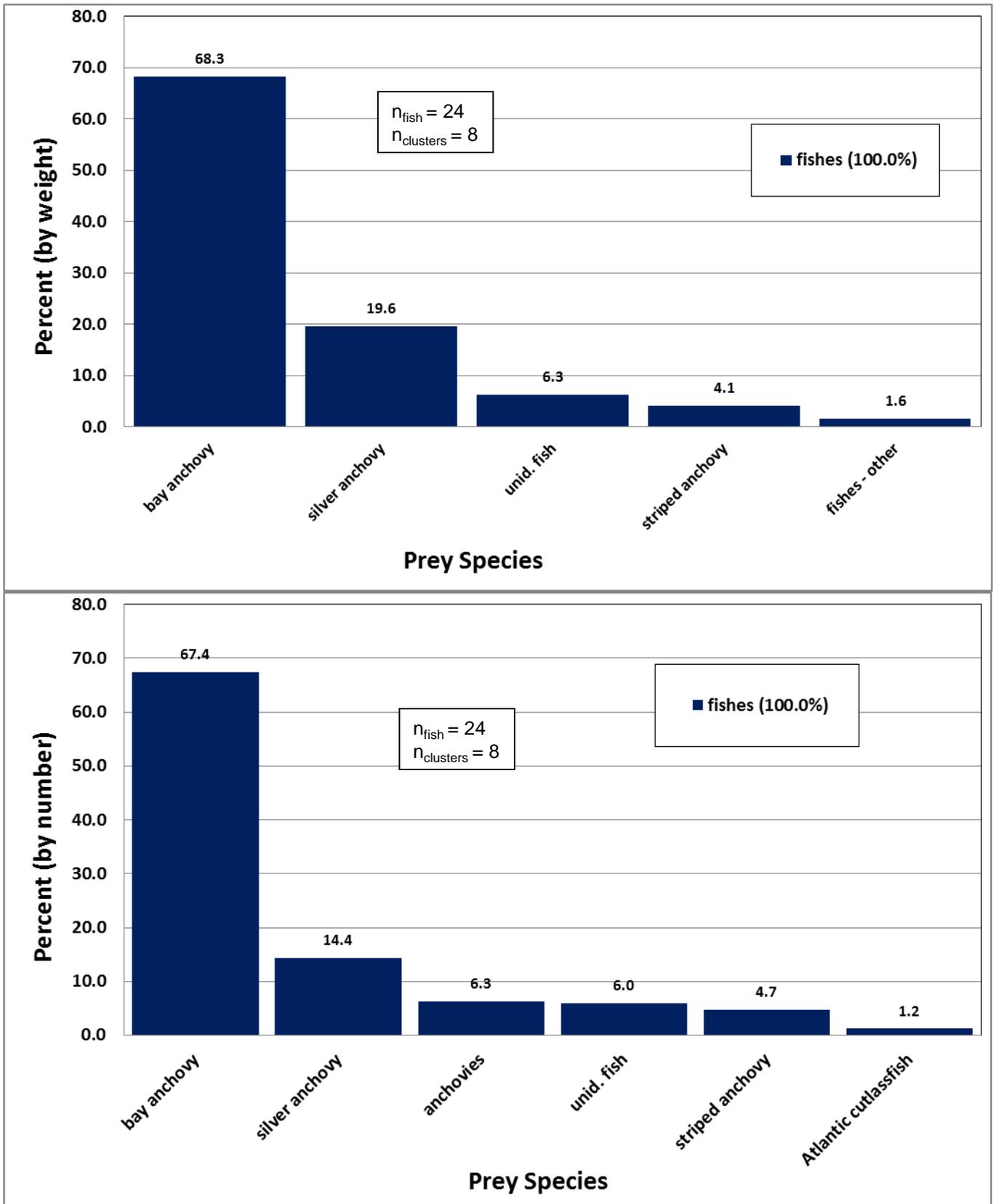


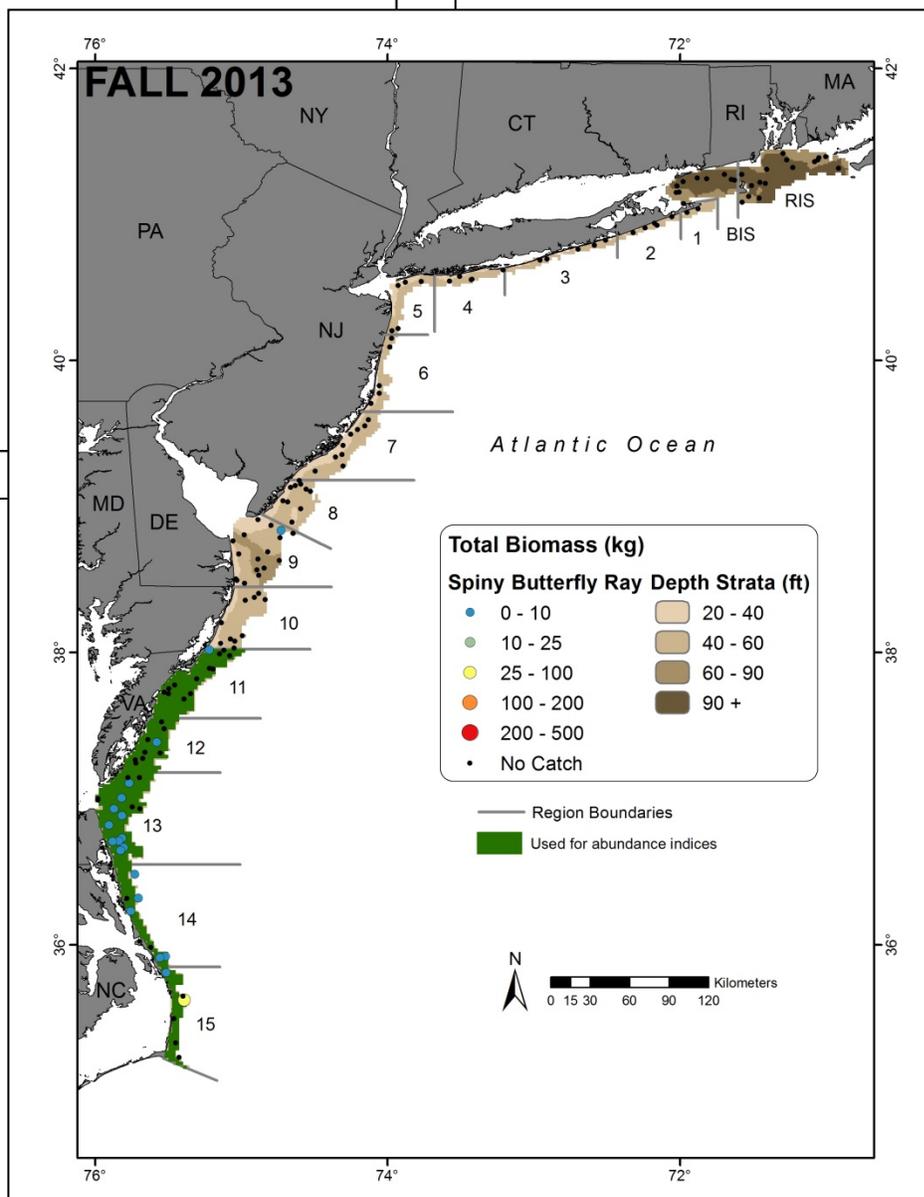
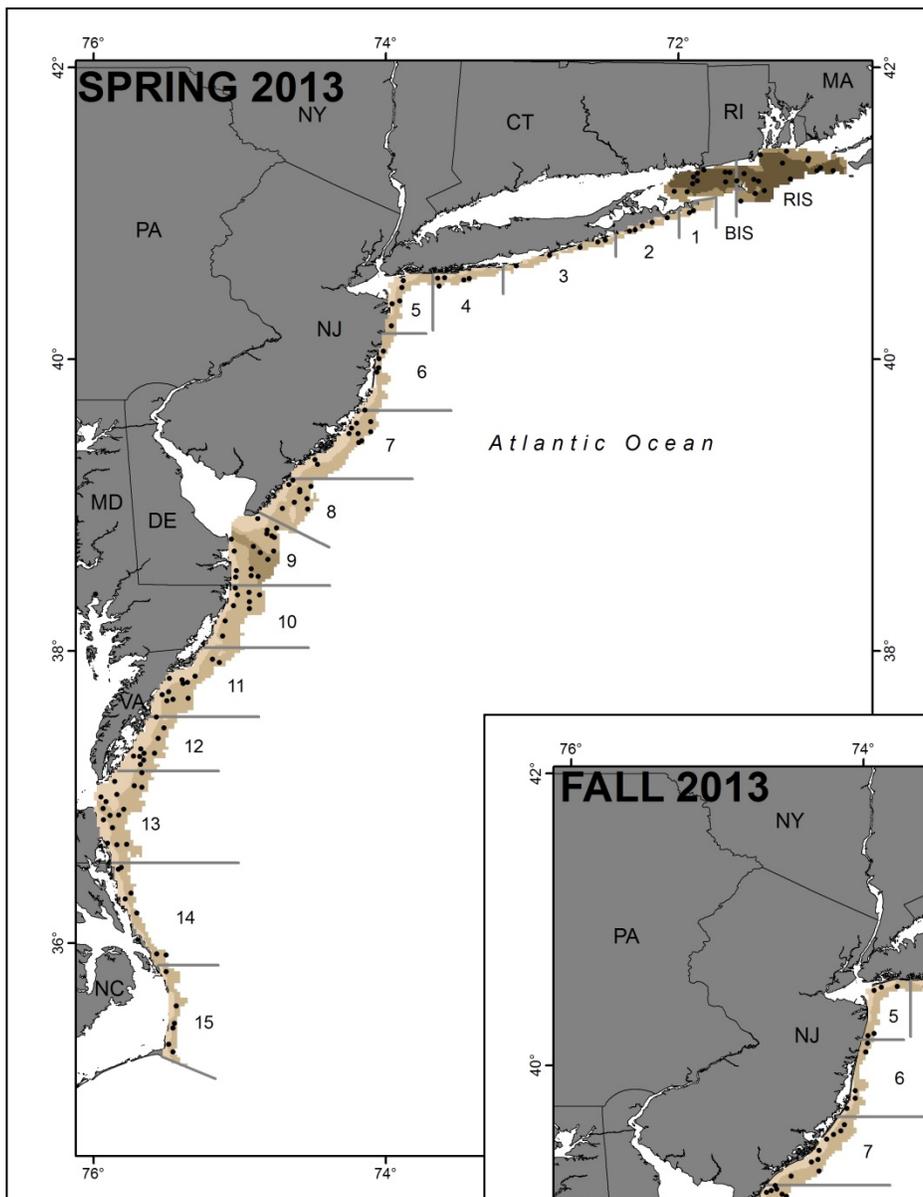
Figure 161. Spanish Mackerel diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2012. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled. Note the very small sample size.)



Spiny Butterfly Ray

Sampling Priority: E

Figure 162. Spiny Butterfly Ray biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	60-90		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 50. Spiny Butterfly Ray sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0	N/A	N/A	N/A	N/A
	2009	0	0.0	0	N/A	N/A	N/A	N/A
	2010	0	0.0	0	N/A	N/A	N/A	N/A
	2011	0	0.0	0	N/A	N/A	N/A	N/A
	2012	8	68.9	8	6	0	0	0
	2013	0	0.0	0	0	0	0	0
Fall	2007	133	1,366.7	133	N/A	N/A	N/A	N/A
	2008	79	809.3	79	N/A	N/A	N/A	N/A
	2009	33	414.3	33	N/A	N/A	N/A	N/A
	2010	96	1,080.7	96	N/A	N/A	N/A	N/A
	2011	118	999.1	118	N/A	N/A	N/A	N/A
	2012	81	1,005.8	81	51	0	0	0
	2013	37	113.5	37	6	0	0	0

Table 51. Spiny Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI
All	2007	56	1.05	1.48	1.99	4.04	6.66	10.65
	2008	51	0.46	0.79	1.19	1.56	2.96	5.13
	2009	53	0.05	0.20	0.37	0.09	0.37	0.72
	2010	51	0.41	0.67	0.98	1.12	1.87	2.89
	2011	51	1.04	1.47	1.99	2.51	3.89	5.80
	2012	51	0.62	0.90	1.23	1.71	2.86	4.51
	2013	51	0.26	0.44	0.64	0.34	0.73	1.23
	2014							
	2015							
	2016							

Figure 163. Spiny Butterfly Ray geometric mean indices of abundance, by number and biomass, for fall NEAMAP surveys, for all specimens captured.

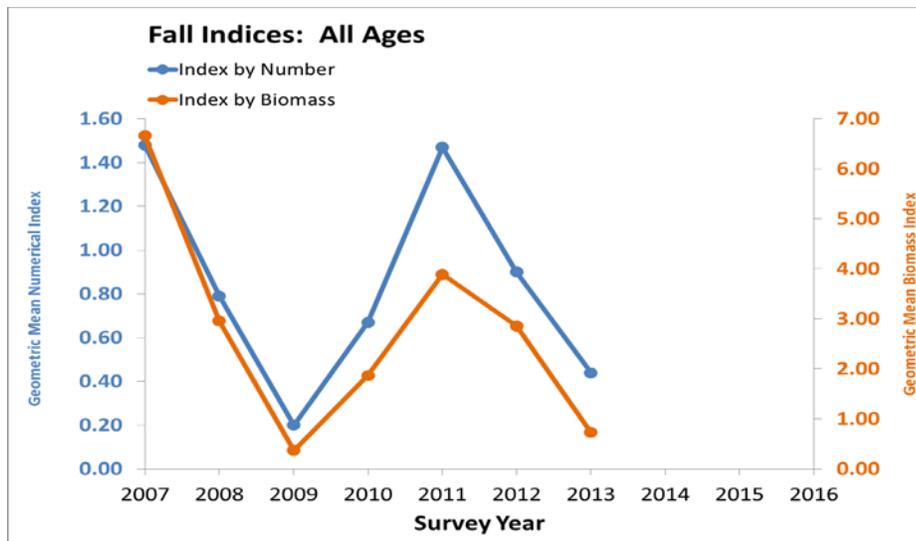


Figure 164. Spiny Butterfly Ray length-frequency distributions, by cruise.

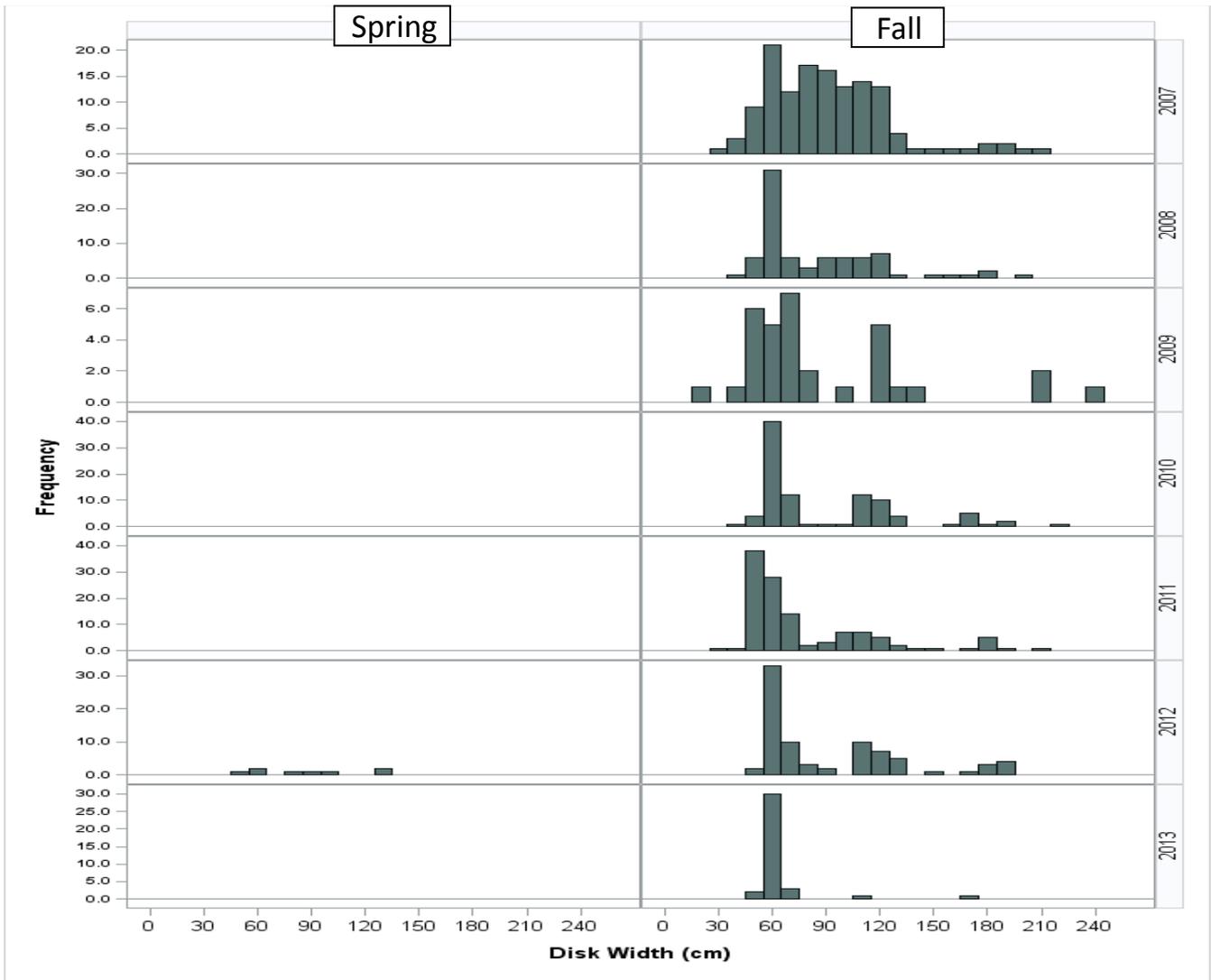
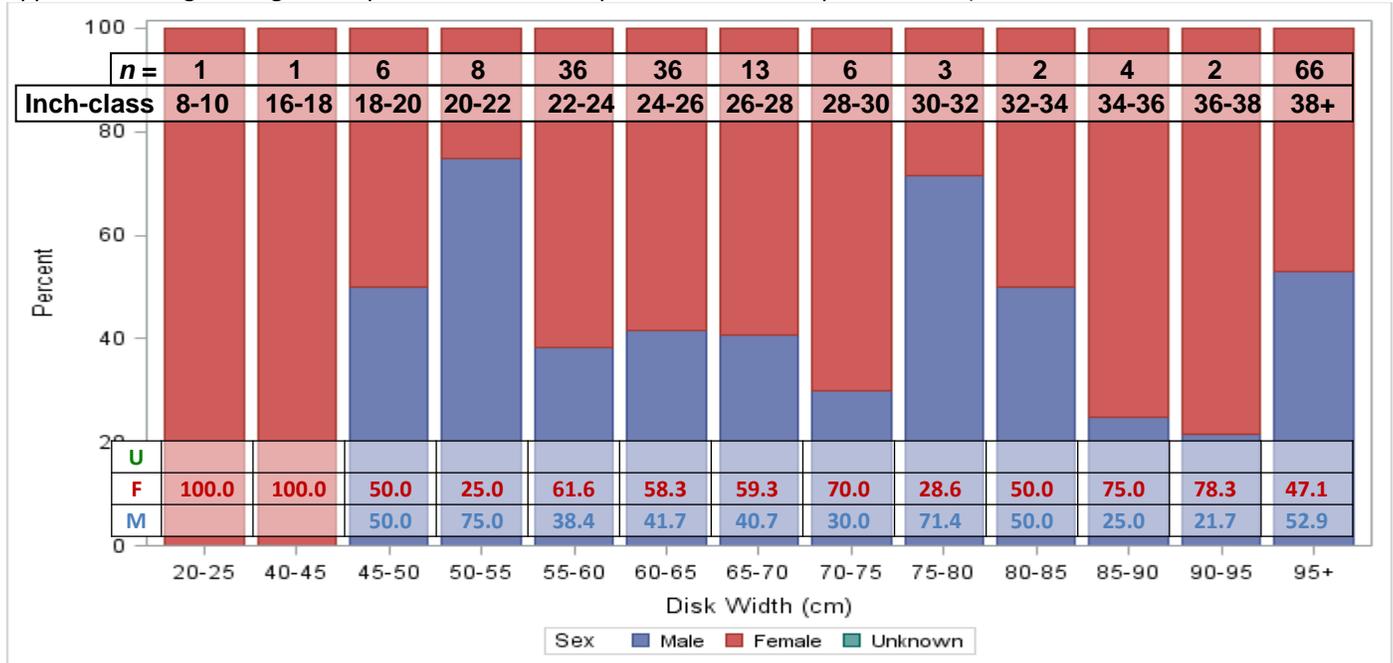


Figure 165. Spiny Butterfly Ray sex ratio, by length group, for all cruises pooled, 2007-2013.

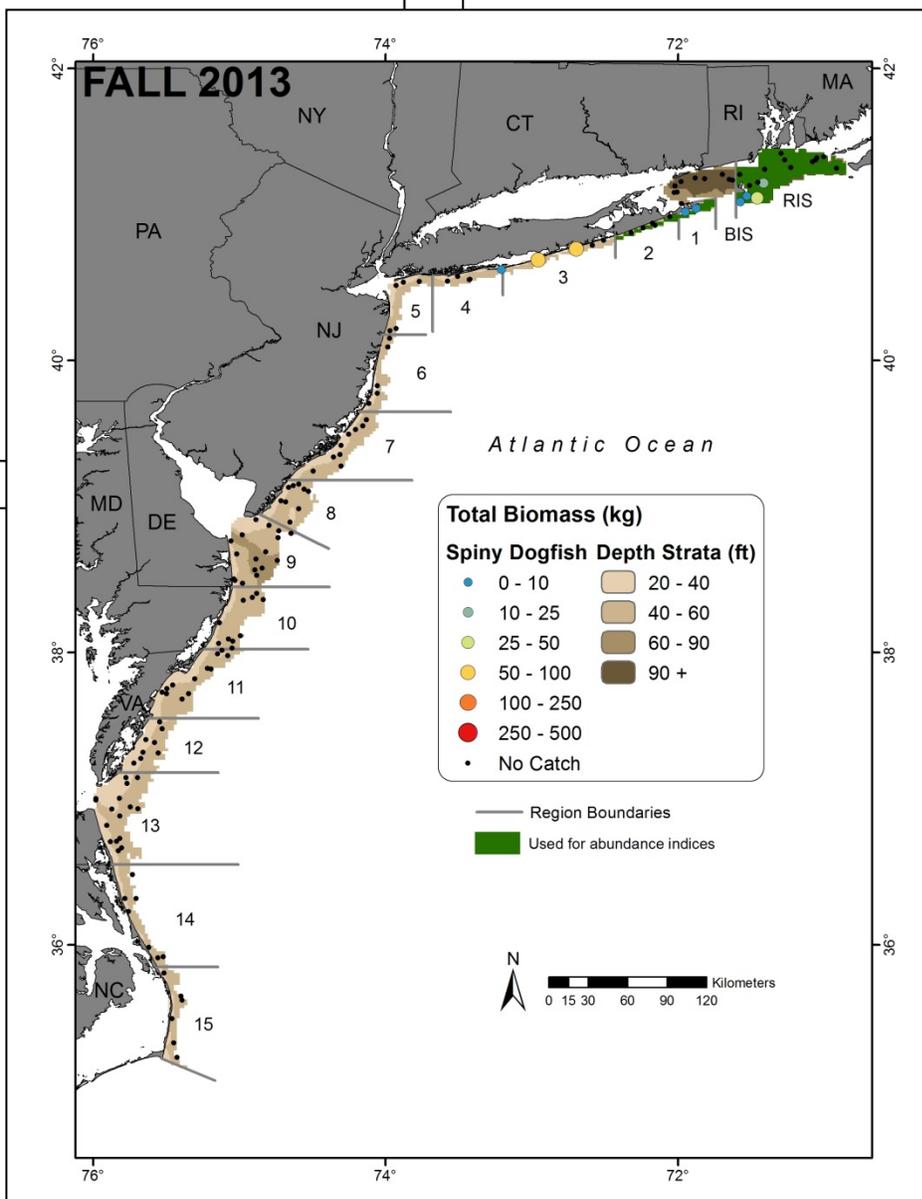
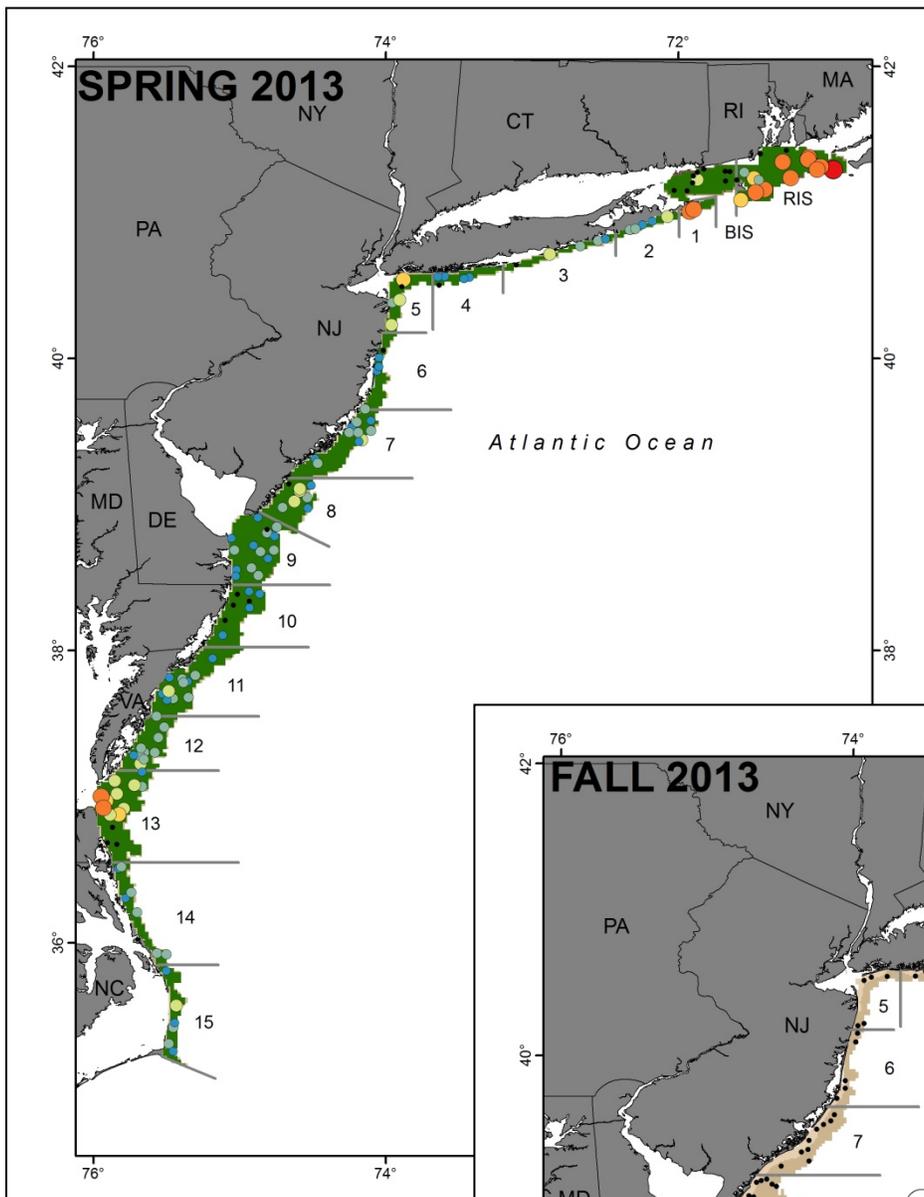
(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)



Spiny Dogfish

Sampling Priority: A

Figure 166. Spiny Dogfish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
	04	40-60		
NJ	05	20-40		
		40-60		
	06	20-40		
DE	07	20-40		
		40-60		
	08	20-40		
MD	09	20-40		
		40-60		
VA	10	20-40		
		40-60		
NC	11	20-40		
		40-60		
	12	20-40		
	13	20-40		
		40-60		
	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Total Biomass (kg)

Spiny Dogfish Depth Strata (ft)

- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 250
- 250 - 500
- No Catch
- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

Region Boundaries
 Used for abundance indices

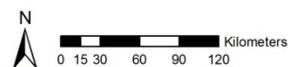


Table 58. Spiny Dogfish sampling rates and preserved specimen workup status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,332	3,399.4	950	325	0	247	247
	2009	1,271	3,577.5	1,137	359	0	261	250
	2010	249	804.1	249	125	0	114	108
	2011	180	548.1	180	139	0	120	113
	2012	762	2,167.1	727	264	0	230	221
	2013	1,838	4,227.8	1,738	371	0	233	192
Fall	2007	17	51.3	17	13	0	12	12
	2008	735	1,621.1	161	41	0	39	39
	2009	795	1,753.1	483	52	0	45	45
	2010	4	11.7	4	4	0	2	2
	2011	40	104.4	40	18	0	6	6
	2012	5	15.5	5	5	0	4	4
	2013	477	992.6	185	29	0	22	0

Table 59. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	22	0.02	0.35	0.80	0.05	0.62	1.52
	2008	150	4.24	4.99	5.86	8.95	10.90	13.24		2008	21	0.58	3.39	11.20	0.90	5.40	20.57
	2009	160	4.24	5.01	5.88	10.51	12.66	15.21		2009	22	0.94	3.02	7.34	1.49	4.97	13.31
	2010	150	0.60	0.78	0.97	1.17	1.54	1.96		2010	21	0.00	0.15	0.35	0.00	0.30	0.75
	2011	150	0.59	0.75	0.92	1.15	1.51	1.94		2011	21	0.04	0.48	1.11	0.07	0.76	1.92
	2012	150	2.16	2.64	3.19	4.65	5.81	7.21		2012	21	0.00	0.18	0.43	0.00	0.34	0.88
	2013	150	3.63	4.46	5.44	6.87	8.72	11.01		2013	21	0.10	0.59	1.31	0.15	0.89	2.08
	2014									2014							
	2015									2015							
	2016									2016							

Figure 167. Spiny Dogfish geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

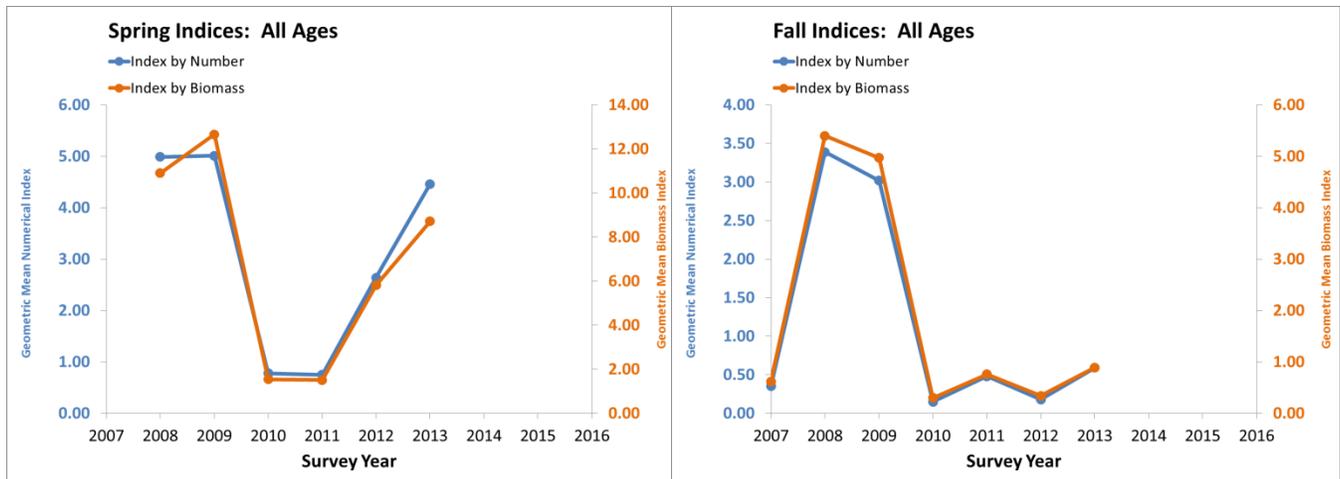


Figure 168. Spiny Dogfish length-frequency distributions, by cruise.

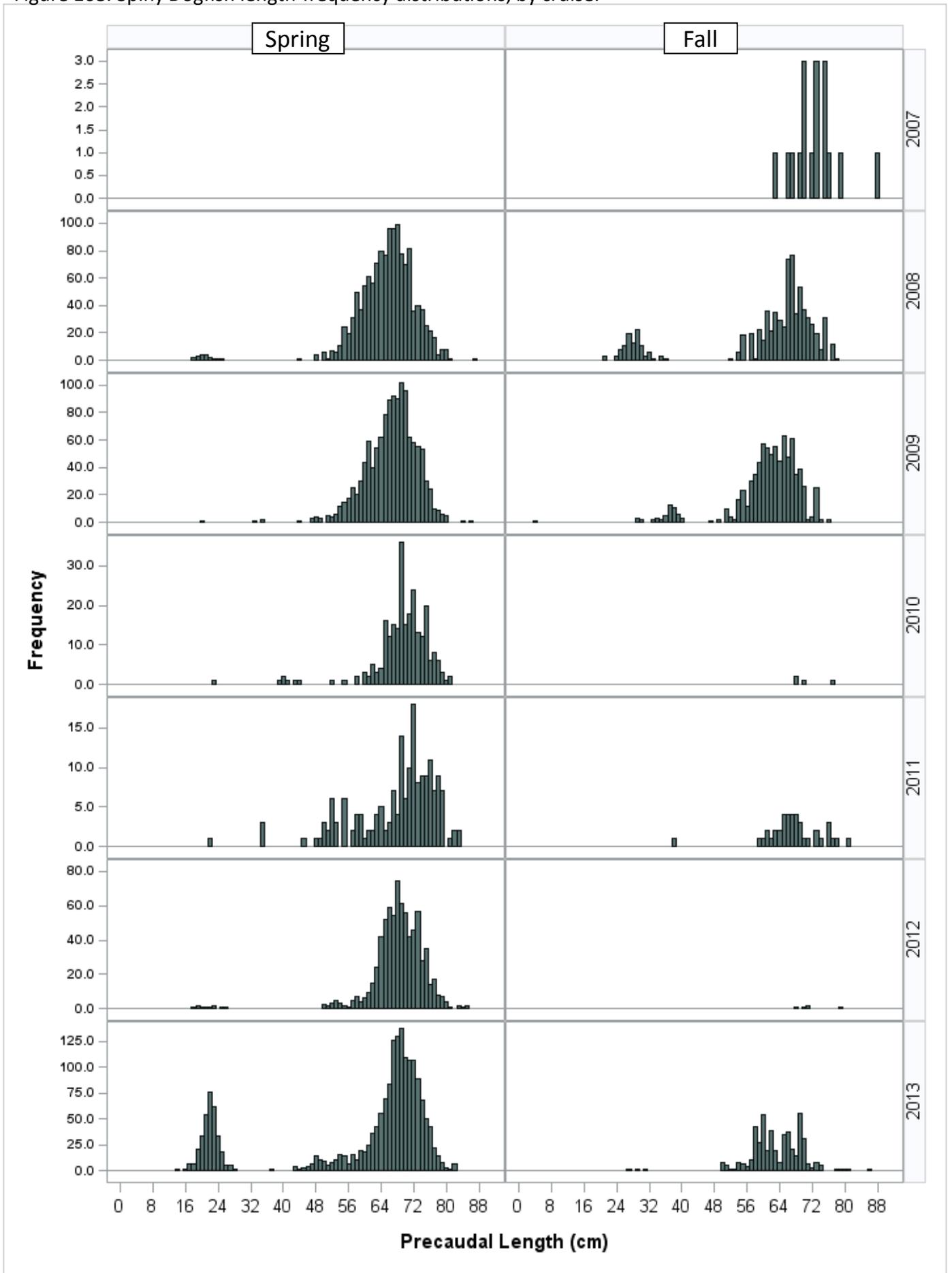


Figure 169. Spiny Dogfish length-frequency distributions, by cruise and sex.

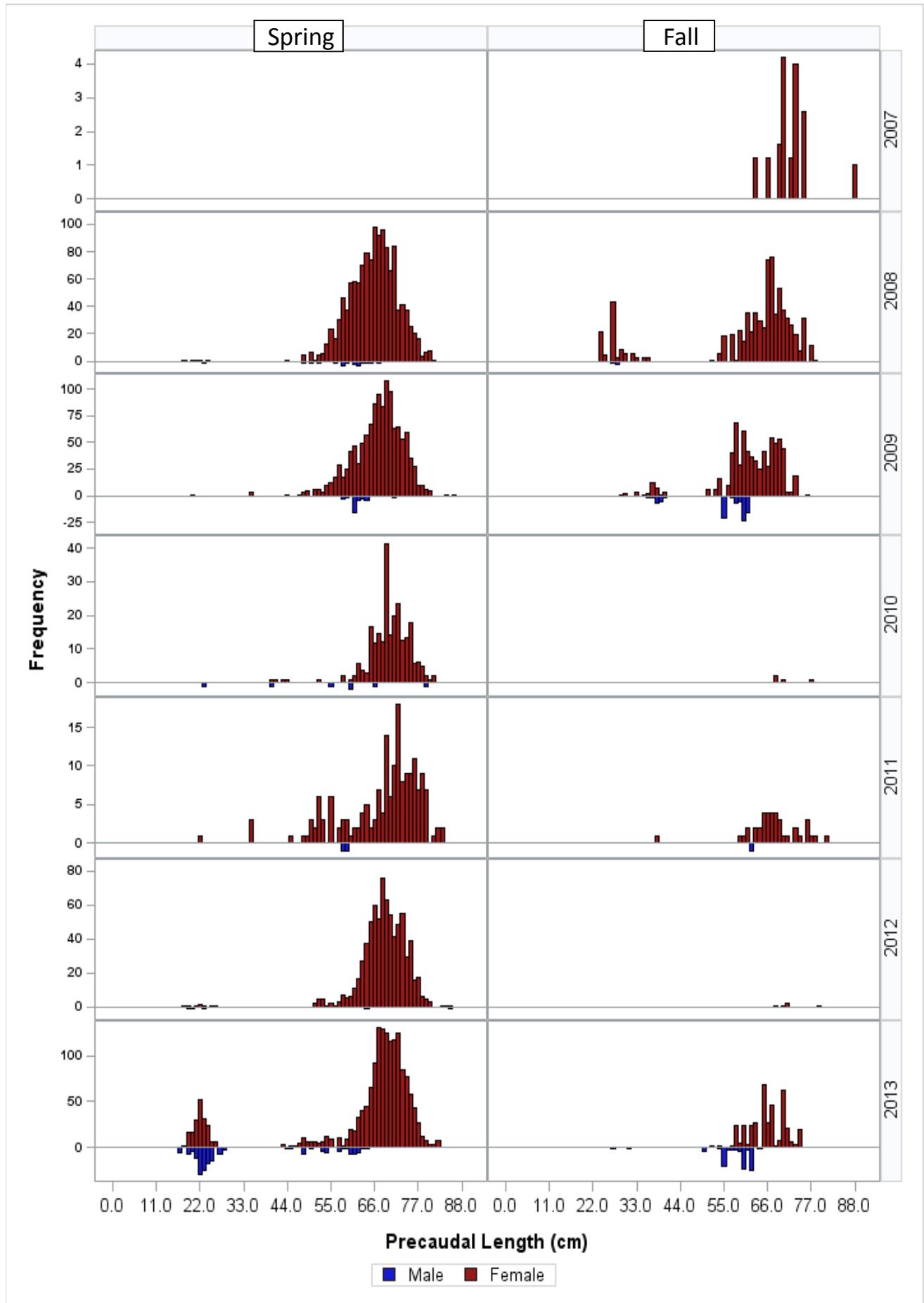


Figure 170. Spiny Dogfish sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

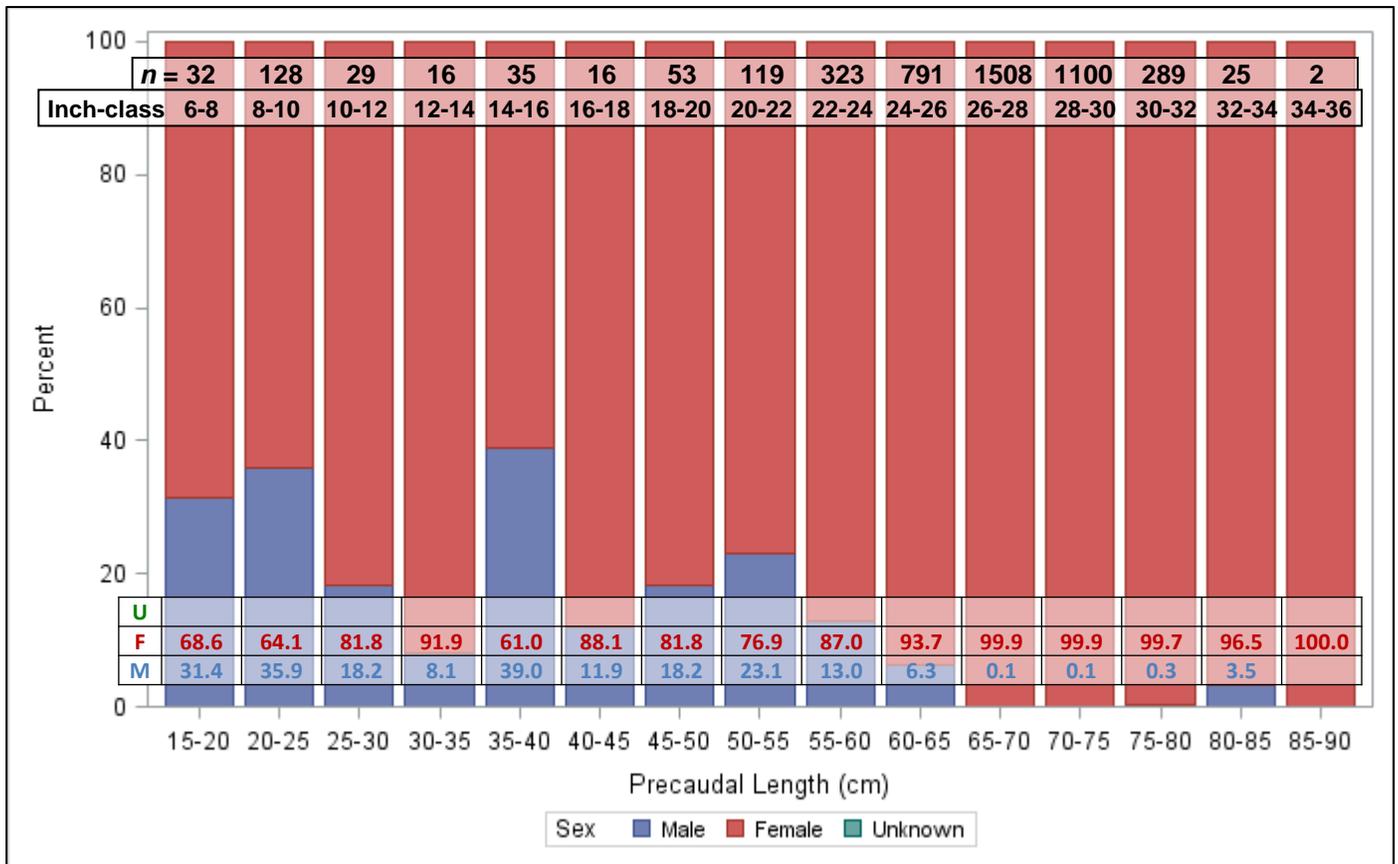


Figure 171. Spiny Dogfish maturity at length, by sex for all cruises pooled, 2007-2013.

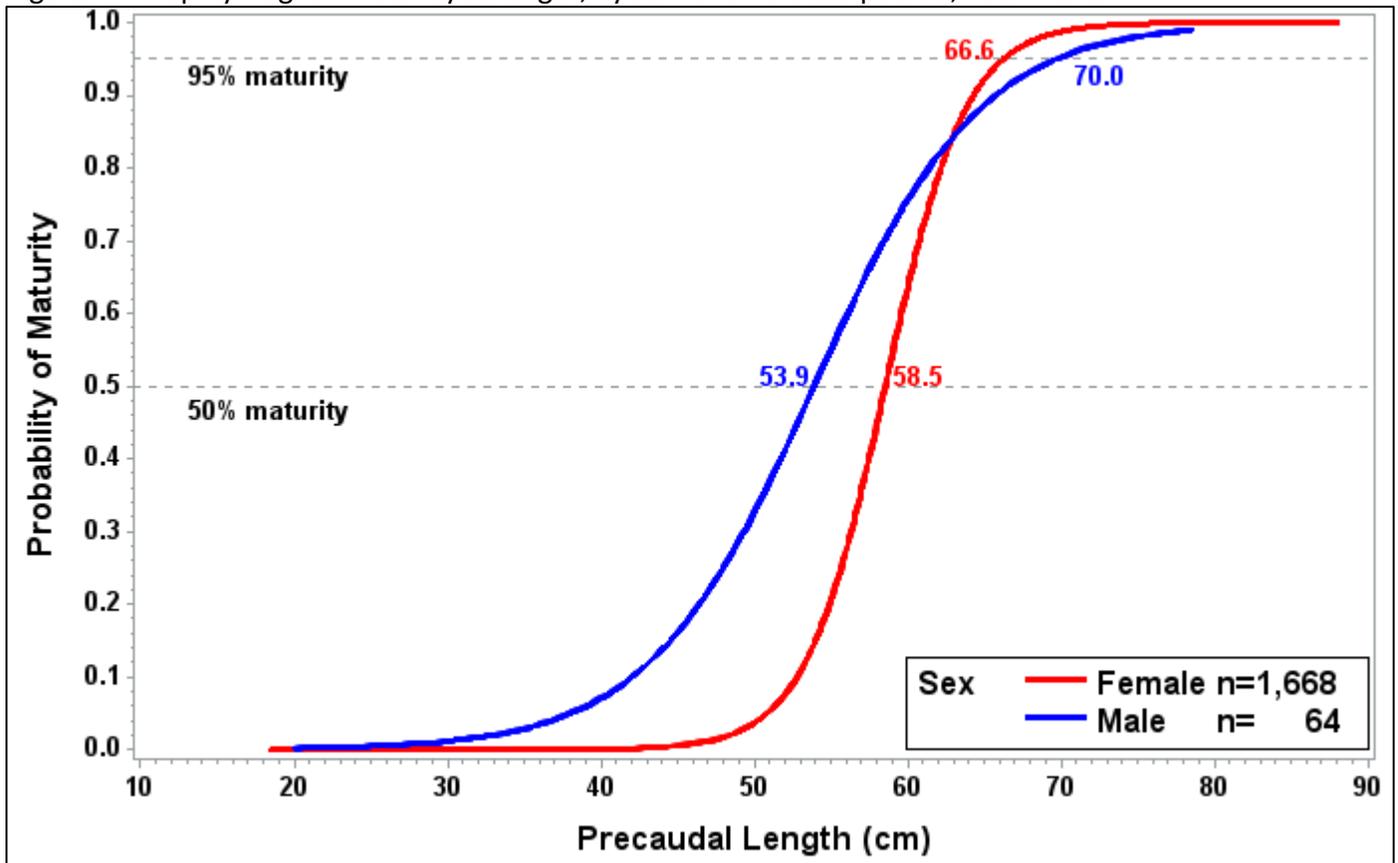


Figure 172. Spiny Dogfish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} while $n_{clusters}$ indicates the number of clusters of this species sampled.)

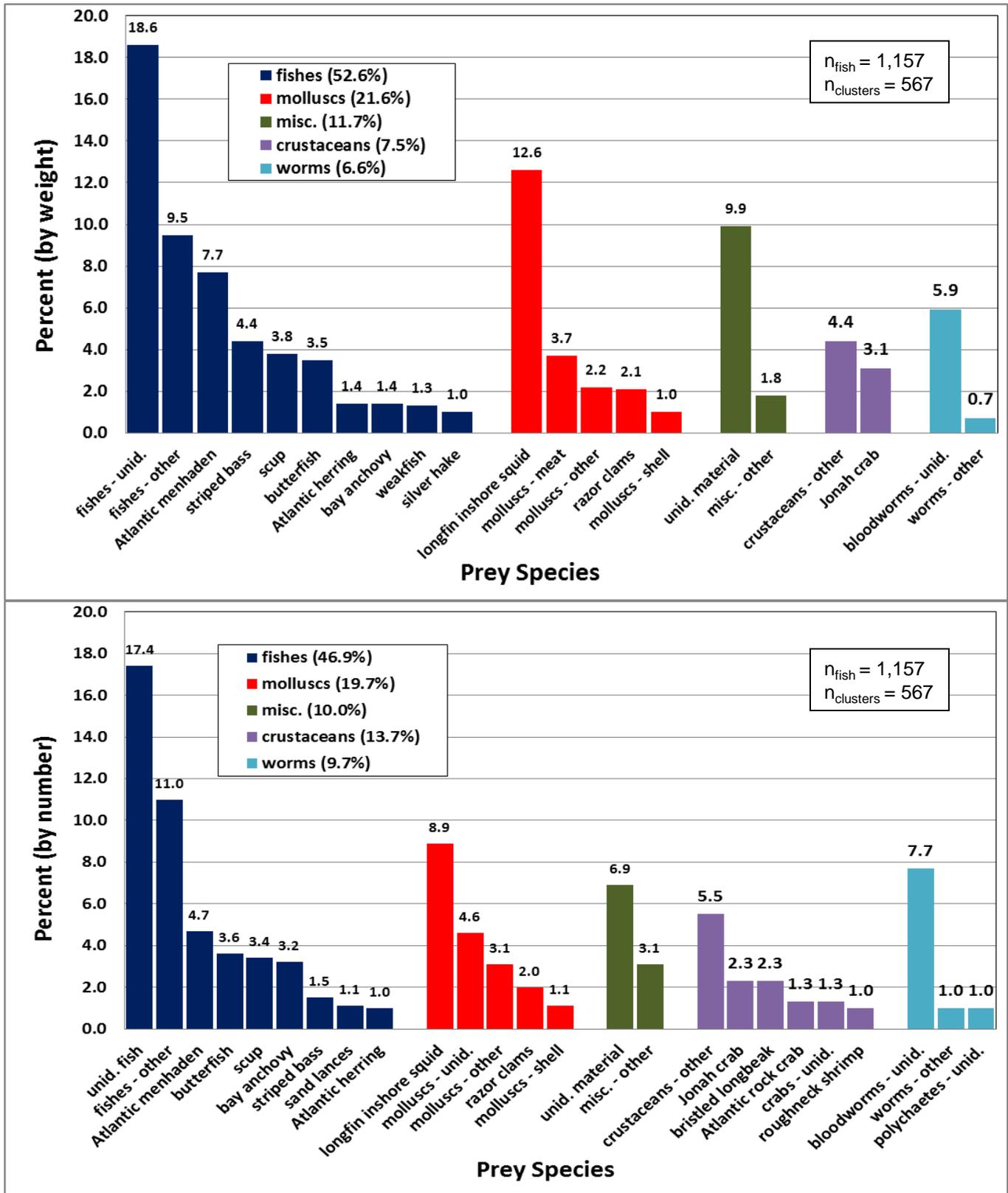
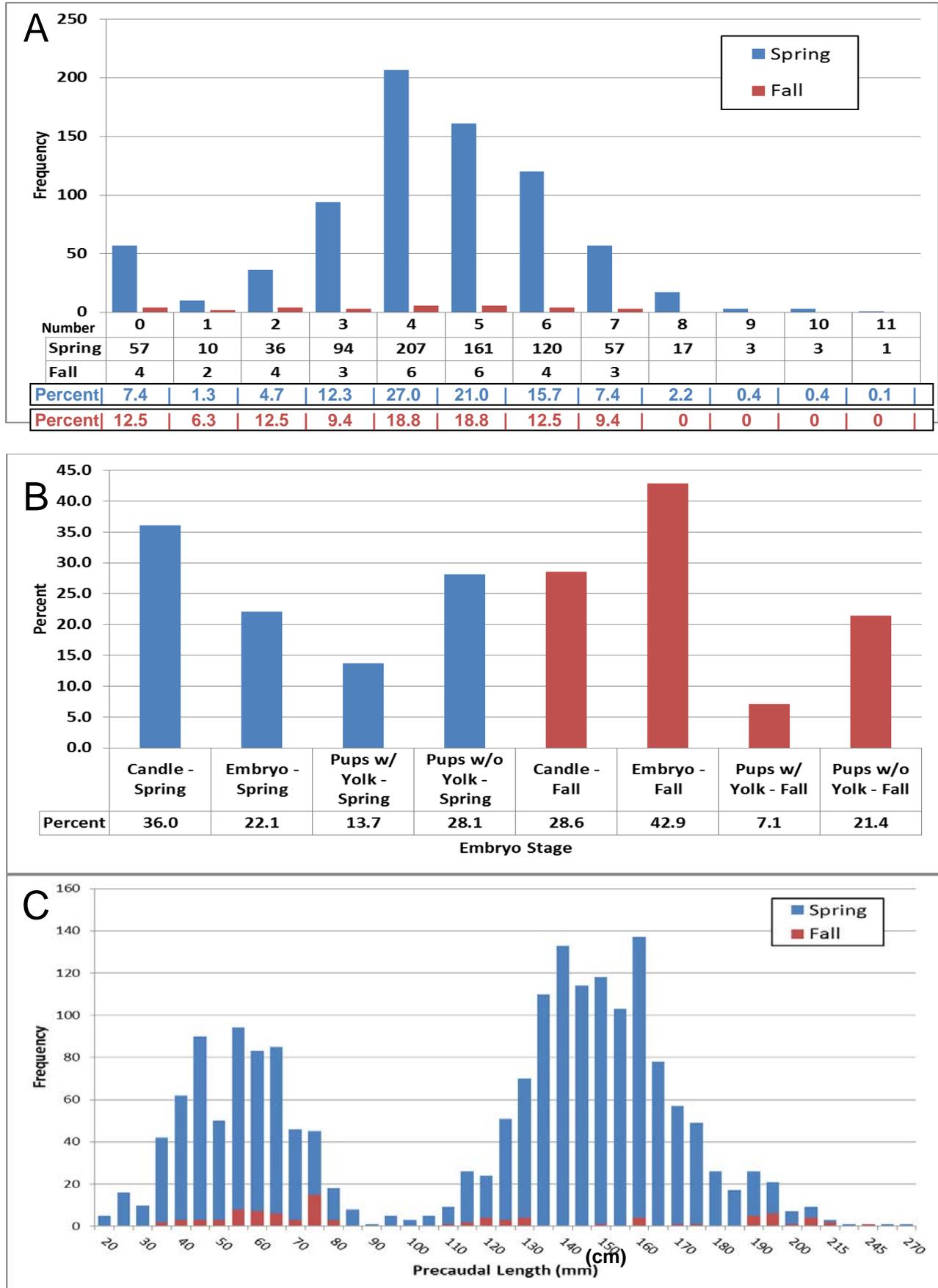


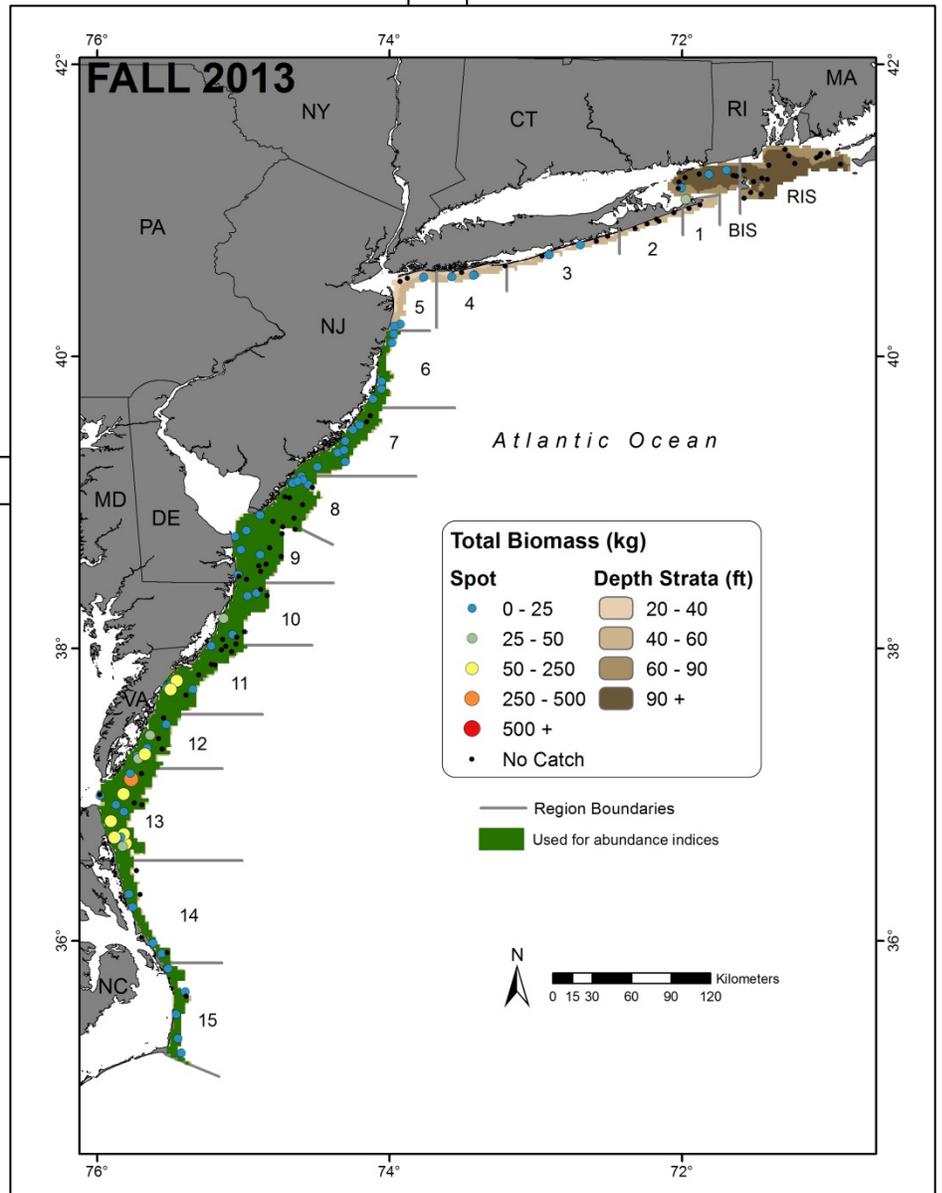
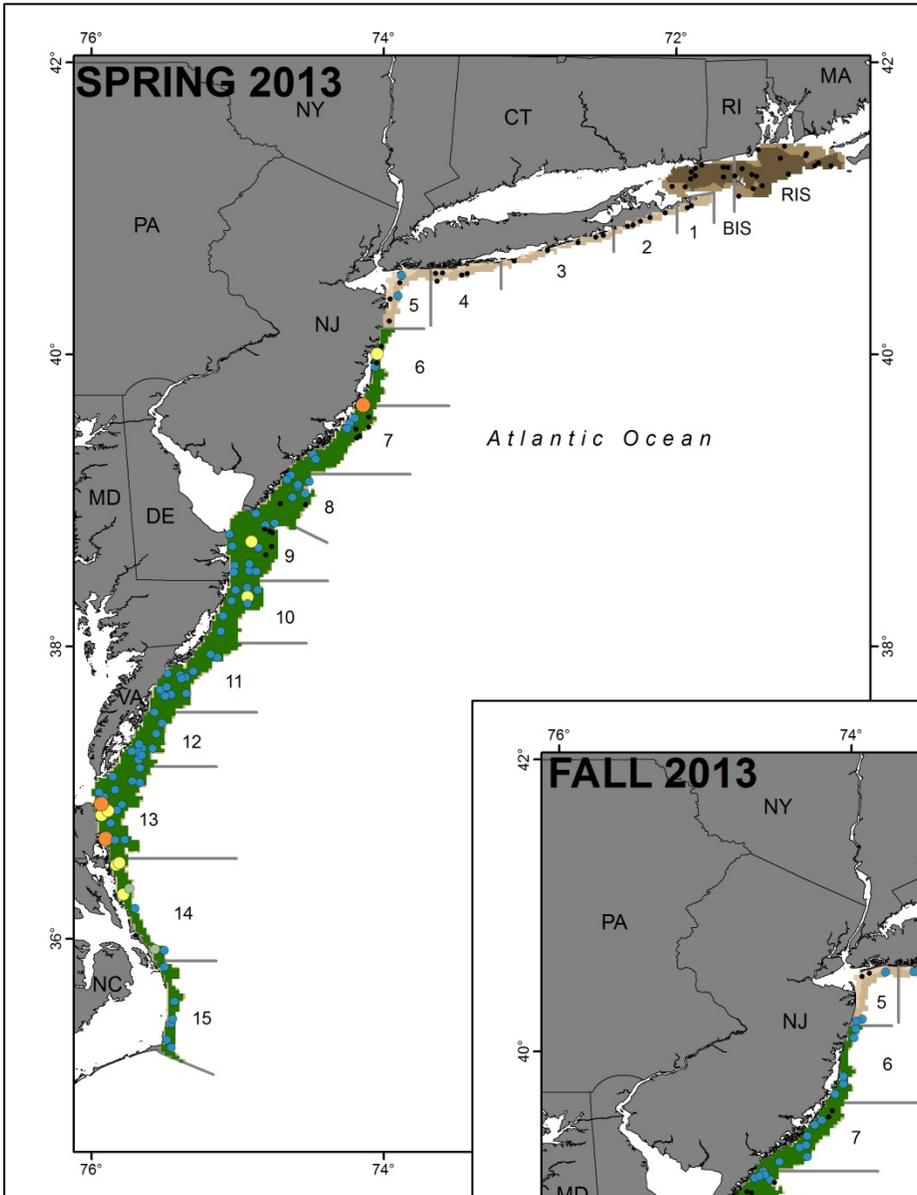
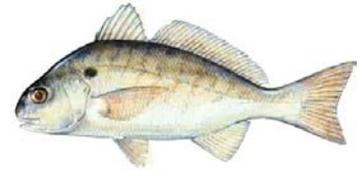
Figure 173. Spiny Dogfish reproductive data by season; A – frequency histogram of number of embryos found in females, B – frequency histogram of embryo stages, C – length-frequency histogram of embryos.



Spot

Sampling Priority: A

Figure 174. Spot biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	60-90		
		90+		
	02	20-40		
	03	40-60		
		20-40		
NJ	04	40-60		
	05	20-40		
		40-60		
DE	06	20-40		
		40-60		
	07	20-40		
		40-60		
MD	08	20-40		
		40-60		
	09	20-40		
VA	10	20-40		
		40-60		
	11	20-40		
NC	12	20-40		
		40-60		
	13	20-40		
NC	14	20-40		
		40-60		
	15	20-40		

= used for abundance indices
 = not used for abundance indices

Table 60. Spot sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	28,561	1,059.2	1,220	61	0	0	0
	2009	29,643	824.9	3,454	59	0	0	0
	2010	19,664	822.1	894	44	0	3	3
	2011	15,390	557.0	2,416	52	0	0	0
	2012	1,600	78.0	873	49	0	14	0
	2013	71,460	2,572.1	10,725	260	0	0	0
Fall	2007	44,437	3,942.1	2,507	160	0	9	0
	2008	56,878	3,872.0	3,435	213	0	0	0
	2009	8,428	593.0	2,699	169	0	0	0
	2010	95,990	5,060.0	6,861	181	0	0	0
	2011	6,407	538.3	1,394	147	0	0	0
	2012	210,331	15,096.9	23,298	338	0	53	0
	2013	19,818	1,871.7	4,827	218	0	0	0

Table 61. Spot geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured and by age class.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	102	7.73	13.53	23.18	2.29	3.65	5.58
	2008	101	1.22	1.91	2.80	0.40	0.64	0.92	2008	102	18.44	32.57	56.97	4.08	6.23	9.30	
	2009	107	0.96	1.70	2.72	0.28	0.55	0.88	2009	107	3.41	4.95	7.03	0.70	1.04	1.45	
	2010	102	0.24	0.66	1.21	0.02	0.24	0.50	2010	102	7.53	13.49	23.62	1.76	2.82	4.28	
	2011	102	0.79	1.46	2.37	0.23	0.48	0.78	2011	102	2.82	4.12	5.87	0.75	1.07	1.46	
	2012	102	0.62	0.95	1.36	0.12	0.25	0.39	2012	102	72.19	120.03	199.15	10.36	15.51	23.00	
	2013	103	37.34	52.46	73.54	3.03	4.13	5.52	2013	103	4.24	7.39	12.42	1.14	1.86	2.83	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	102	6.12	10.54	17.68	1.81	2.87	4.33
	2008								2008	102	15.93	27.75	47.82	3.54	5.35	7.87	
	2009								2009	107	2.90	4.16	5.83	0.59	0.89	1.24	
	2010								2010	102	6.84	12.19	21.22	1.60	2.57	3.90	
	2011								2011	102	2.10	3.04	4.26	0.55	0.80	1.09	
	2012								2012	102	59.01	97.18	159.61	8.59	12.77	18.77	
	2013								2013	103	3.27	5.66	9.39	0.88	1.44	2.16	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007								1	2007	102	4.42	7.31	11.75	1.25	1.94	2.85
	2008	101	1.22	1.90	2.80	0.40	0.64	0.92	2008	102	7.20	11.63	18.48	1.52	2.26	3.22	
	2009	107	0.96	1.70	2.72	0.28	0.55	0.88	2009	107	1.23	1.84	2.60	0.20	0.36	0.55	
	2010	102	0.24	0.66	1.21	0.02	0.24	0.50	2010	102	2.42	3.81	5.78	0.52	0.80	1.12	
	2011	102	0.79	1.45	2.37	0.23	0.48	0.78	2011	102	1.56	2.24	3.10	0.38	0.57	0.78	
	2012	102	0.61	0.95	1.36	0.13	0.25	0.39	2012	102	21.63	33.48	51.54	3.20	4.64	6.58	
	2013	103	37.07	52.04	72.88	3.02	4.10	5.48	2013	103	2.18	3.65	5.78	0.57	0.96	1.45	
	2014								2014								
	2015								2015								
	2016								2016								
2+	2007								2+	2007	102	0.24	0.43	0.65	0.04	0.10	0.16
	2008	101	0.03	0.17	0.32	0.00	0.03	0.07	2008	102	0.11	0.25	0.41	0.01	0.05	0.09	
	2009	107	0.02	0.08	0.15	0.00	0.01	0.01	2009	107	0.01	0.06	0.11	0.00	0.01	0.02	
	2010	102	0.00	0.12	0.29	0.00	0.03	0.09	2010	102	0.03	0.07	0.11	0.00	0.01	0.01	
	2011	102	0.01	0.07	0.13	0.00	0.01	0.02	2011	102	0.10	0.18	0.27	0.01	0.04	0.06	
	2012	102	0.00	0.07	0.14	0.00	0.01	0.03	2012	102	0.39	0.69	1.05	0.06	0.16	0.27	
	2013	103	0.25	0.49	0.78	0.03	0.11	0.19	2013	103	0.22	0.44	0.71	0.04	0.14	0.24	
	2014								2014								
	2015								2015								
	2016								2016								

Figure 175. Spot geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys and by age class.

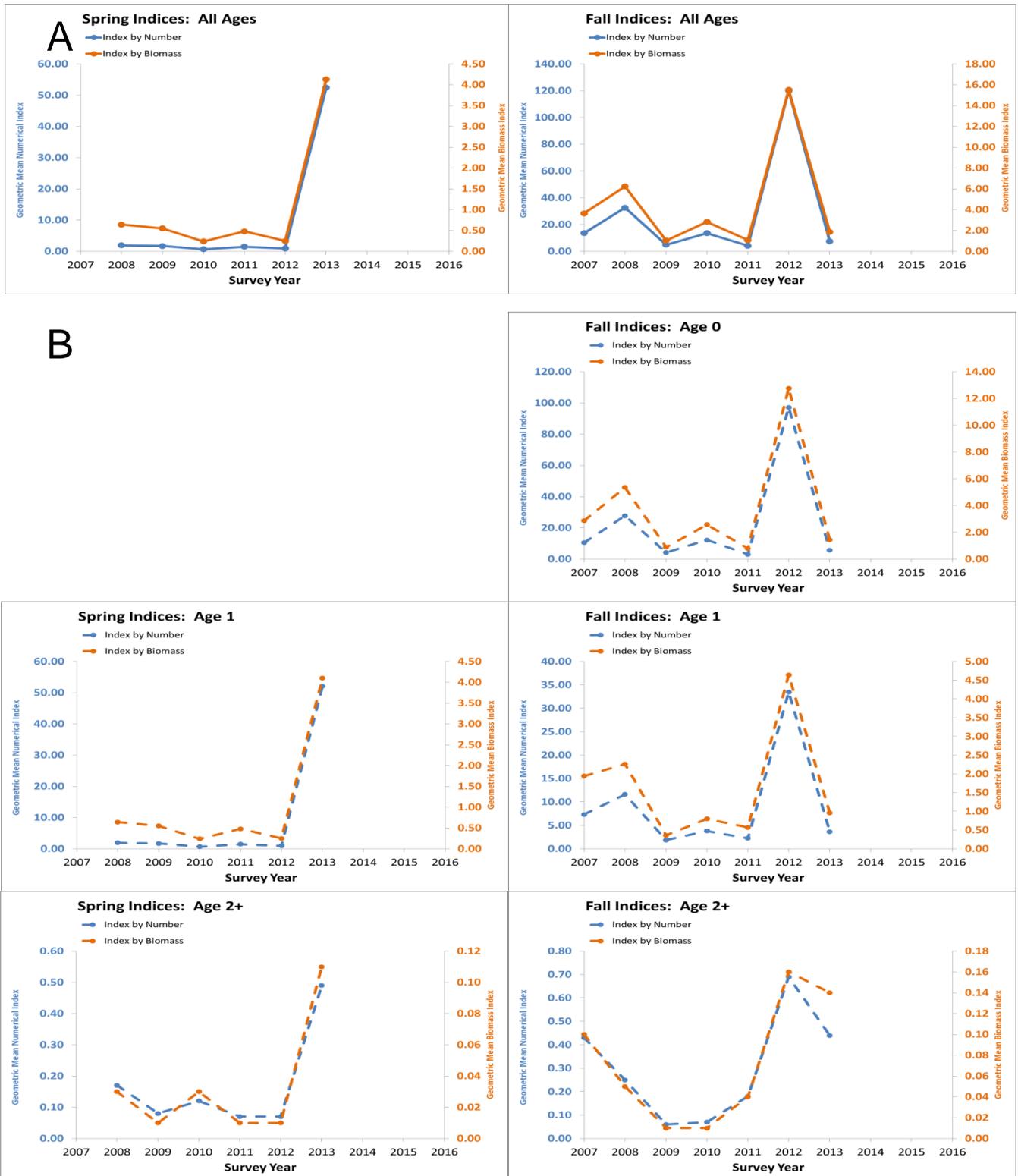


Figure 176. Spot length-frequency distributions, by cruise.

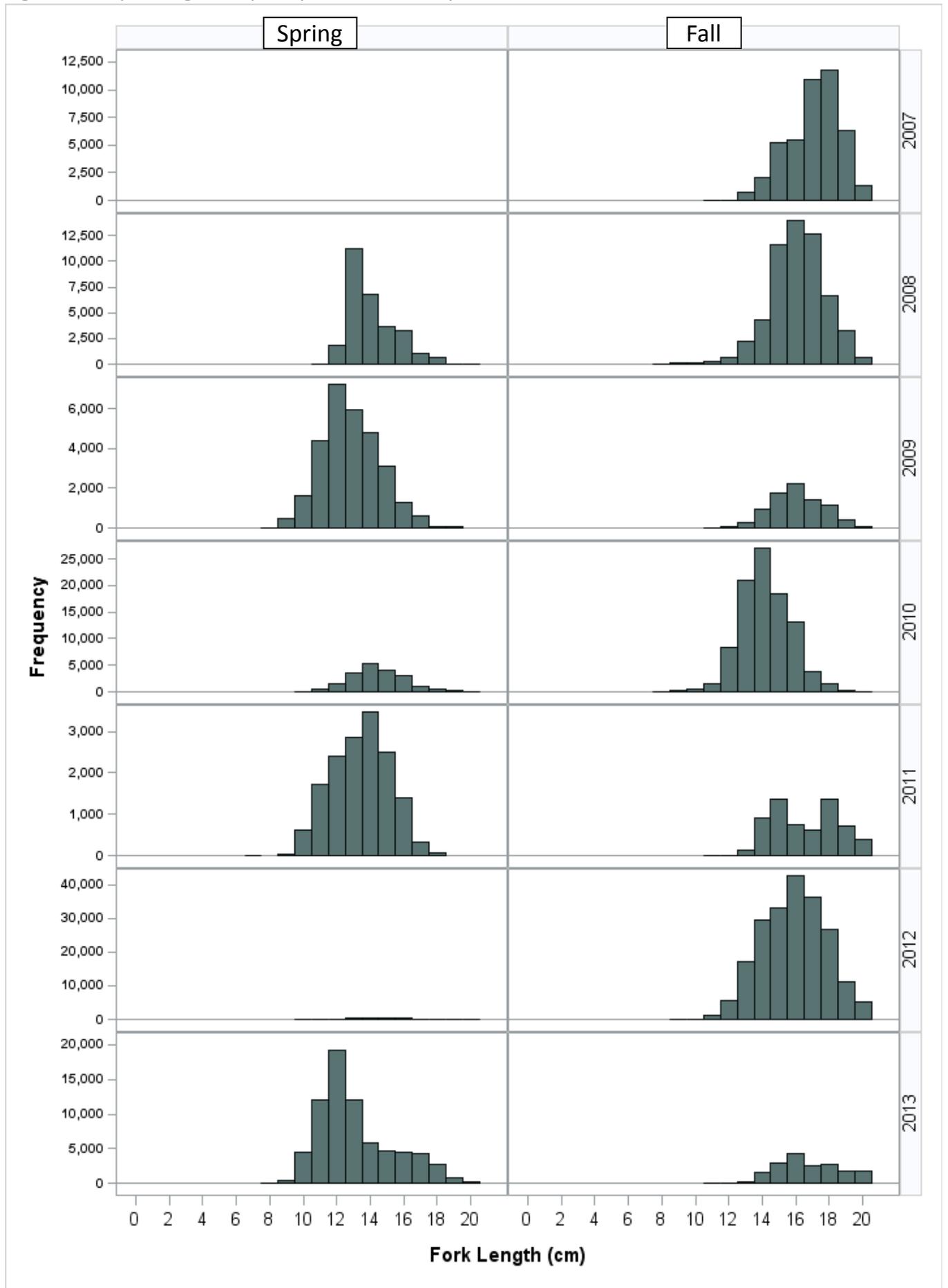


Figure 177. Spot sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

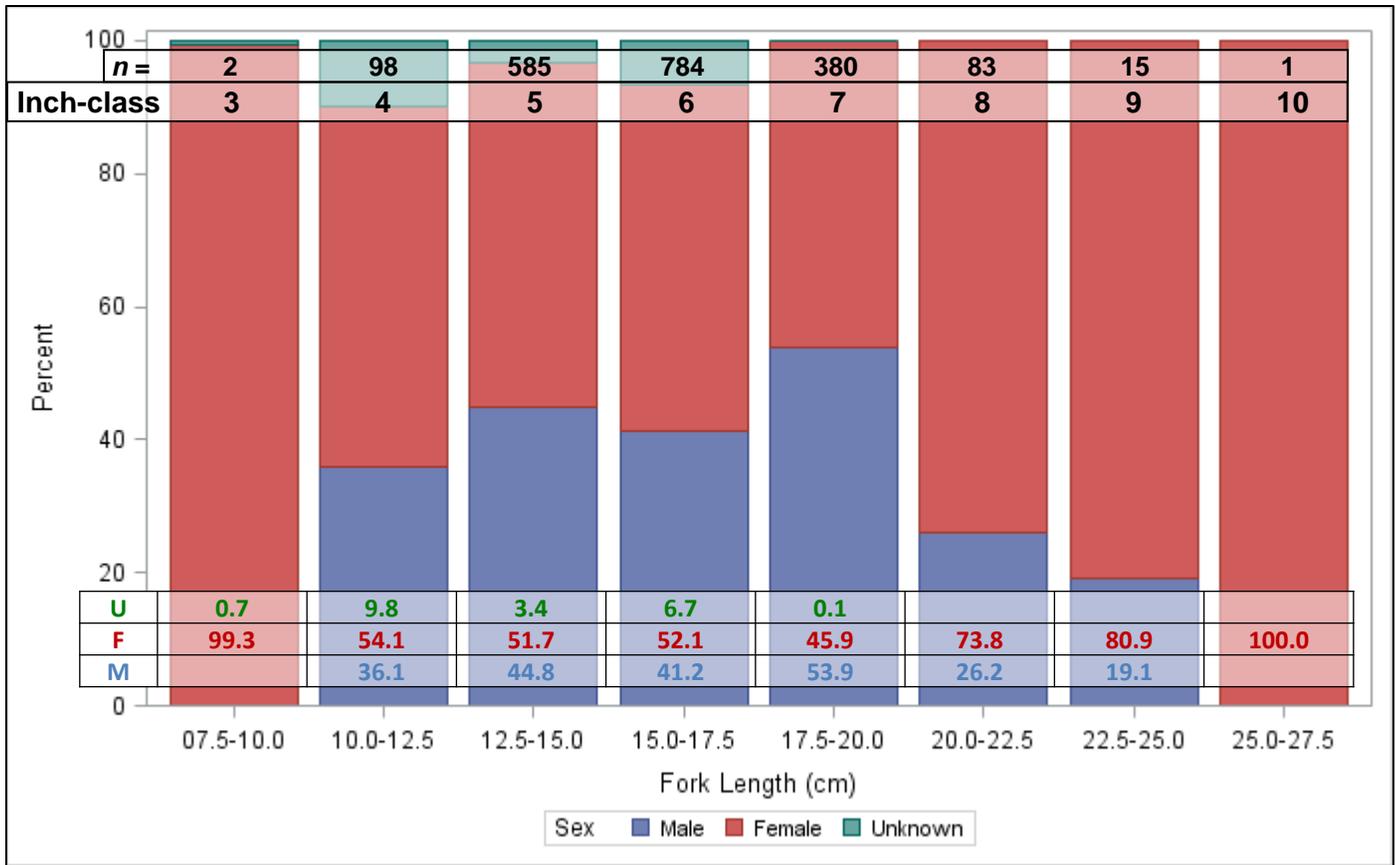
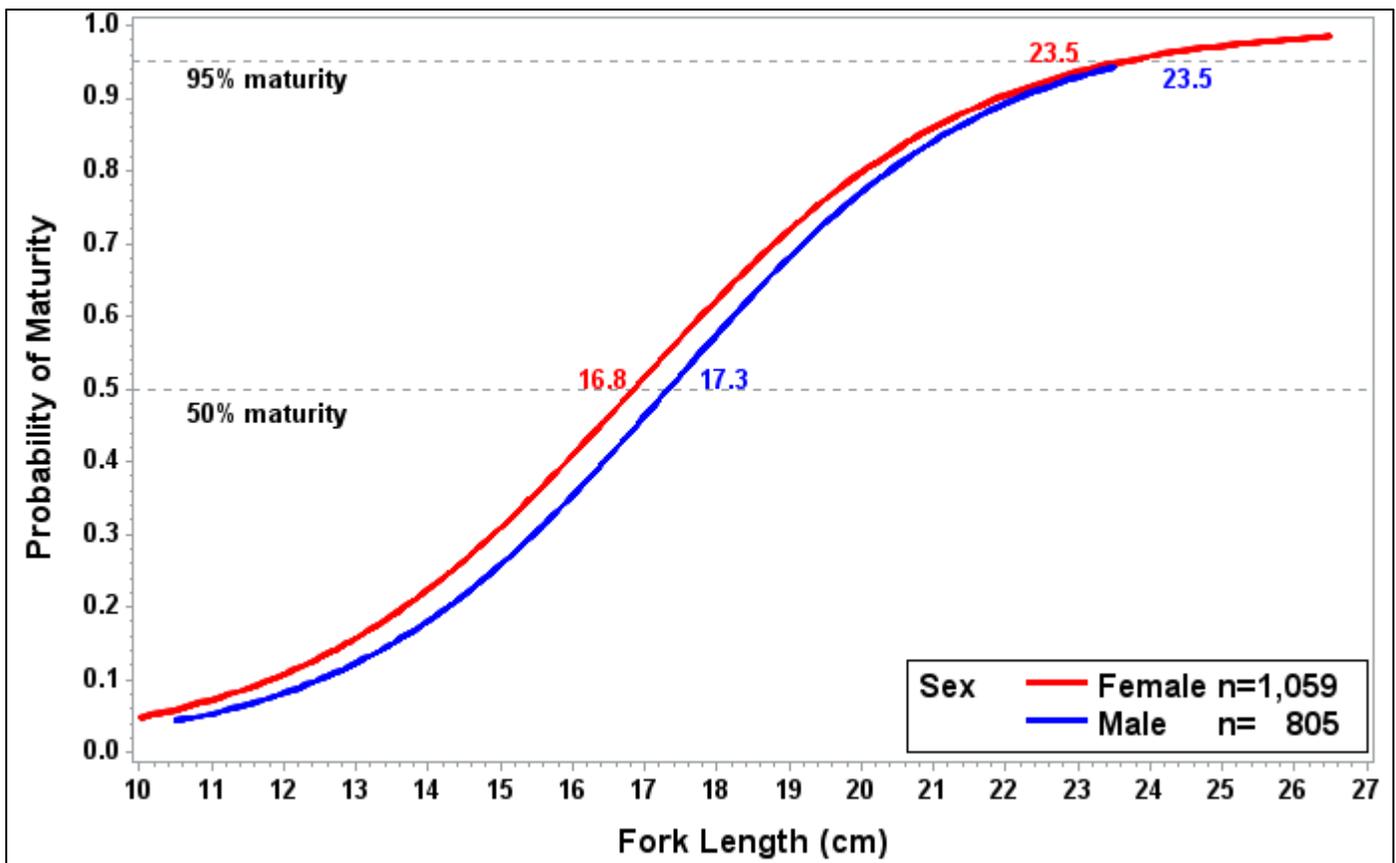


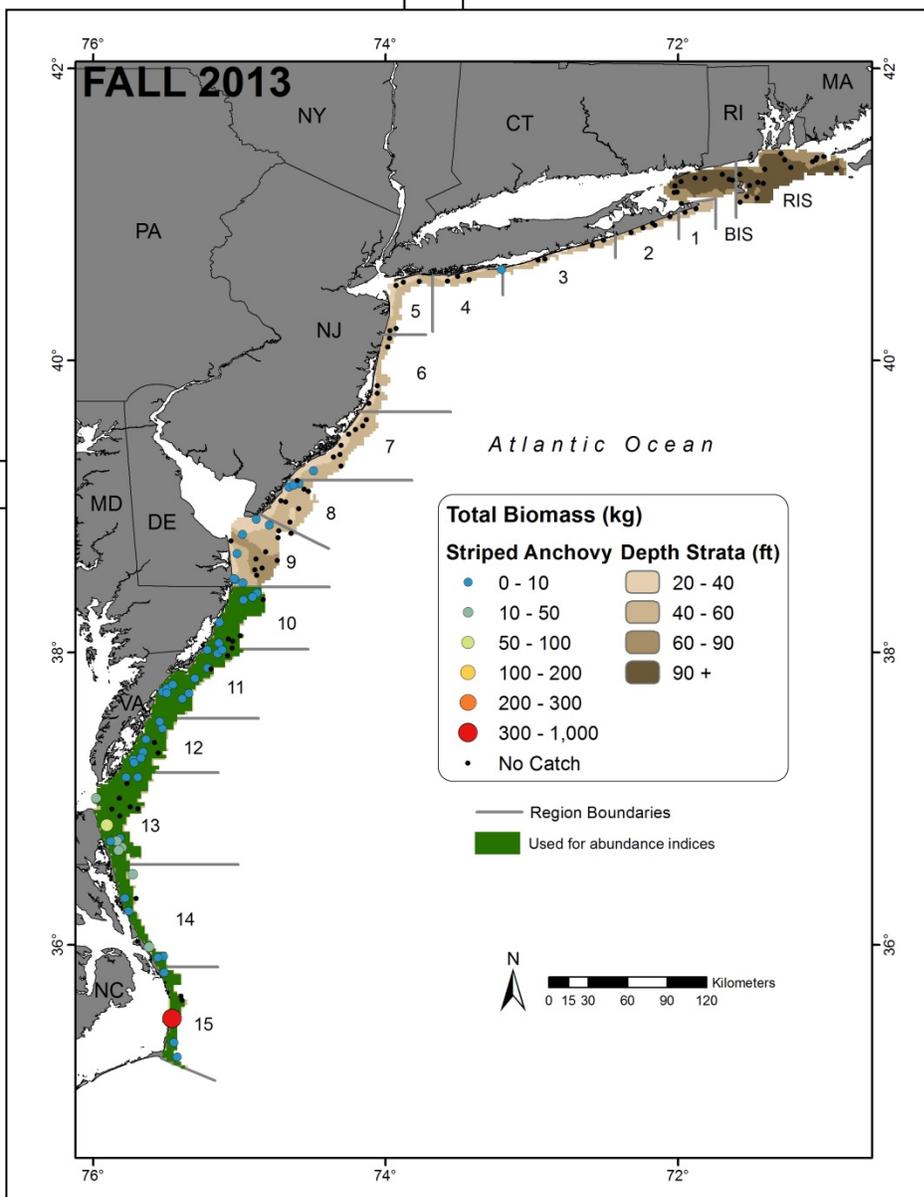
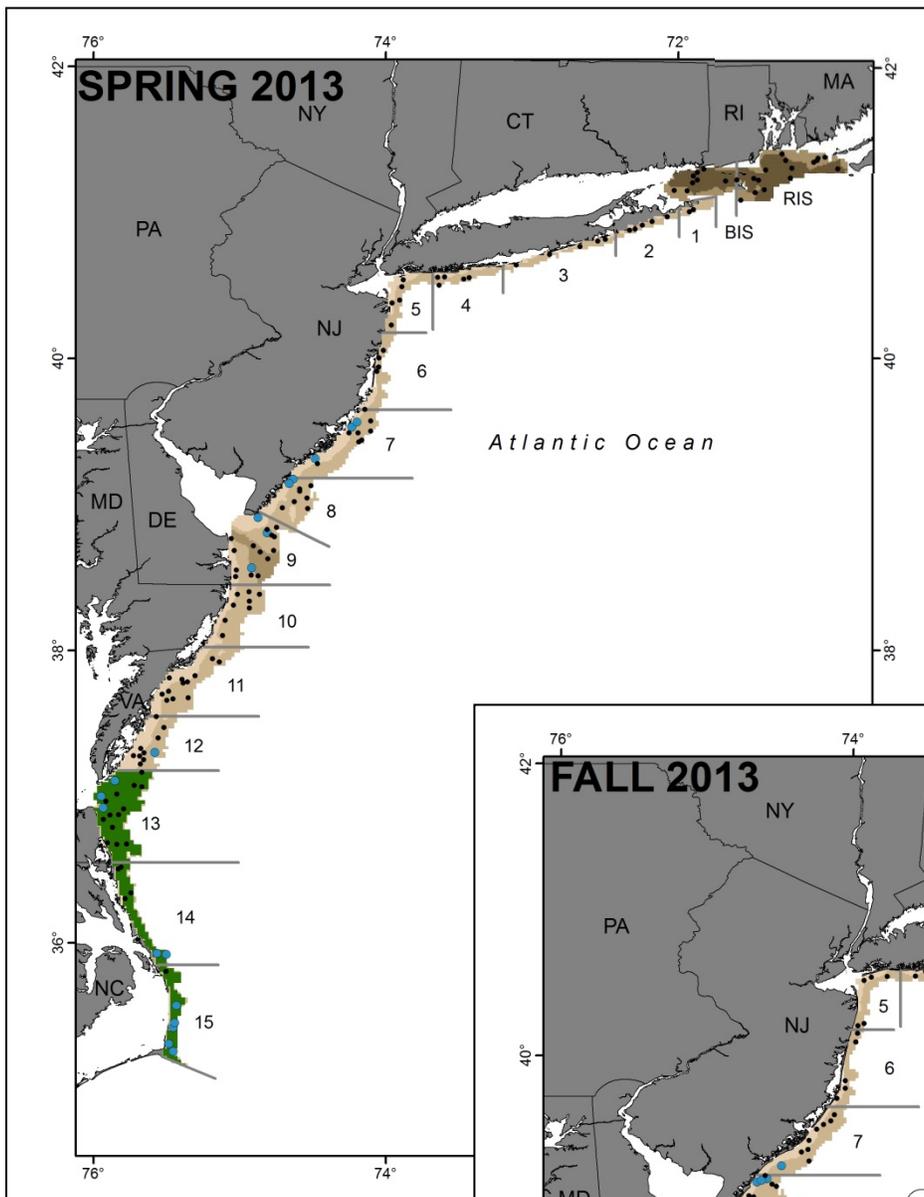
Figure 178. Spot maturity at length, by sex for all cruises pooled, 2007-2013.



Striped Anchovy

Sampling Priority: D

Figure 179. Striped Anchovy biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
NY	01	40-60		
		20-40		
		40-60		
		20-40		
		40-60		
NJ	06	20-40		
		40-60		
		20-40		
		40-60		
		40-60		
DE	09	20-40		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		40-60		
NC	14	20-40		
		40-60		
		20-40		
NC	15	20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 62. Striped Anchovy sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,198	19.0	471	N/A	N/A	N/A	N/A
	2009	104	1.5	104	N/A	N/A	N/A	N/A
	2010	4	0.1	4	N/A	N/A	N/A	N/A
	2011	4,381	68.9	665	N/A	N/A	N/A	N/A
	2012	15,427	173.7	2,799	N/A	N/A	N/A	N/A
	2013	611	4.7	430	N/A	N/A	N/A	N/A
Fall	2007	224,369	2,519.3	4,990	N/A	N/A	N/A	N/A
	2008	84,833	1,009.1	3,357	N/A	N/A	N/A	N/A
	2009	9,820	130.8	2,407	N/A	N/A	N/A	N/A
	2010	67,774	849.8	4,418	N/A	N/A	N/A	N/A
	2011	73,546	932.5	5,704	N/A	N/A	N/A	N/A
	2012	289,800	3,064.7	17,789	N/A	N/A	N/A	N/A
	2013	40,977	587.8	4,180	N/A	N/A	N/A	N/A

Table 63. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey						Fall Survey											
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	66	50.45	100.50	199.23	2.59	4.30	6.82
	2008	31	3.57	7.91	16.39	0.09	0.36	0.69		2008	61	69.74	149.20	317.90	2.71	4.57	7.36
	2009	31	0.00	0.22	0.83	0.00	0.04	0.13		2009	64	7.13	11.67	18.75	0.39	0.65	0.95
	2010	29	0.00	0.06	0.14	0.00	0.00	0.01		2010	61	5.66	10.92	20.34	0.66	1.18	1.86
	2011	29	0.56	2.10	5.14	0.04	0.39	0.86		2011	61	55.10	111.07	222.89	2.40	3.75	5.65
	2012	29	36.96	81.81	179.66	1.32	2.33	3.77		2012	61	177.49	345.26	670.70	5.33	8.02	11.83
	2013	29	0.50	1.23	2.33	0.00	0.07	0.14		2013	61	13.08	28.41	60.43	1.02	1.69	2.57
	2014									2014							
	2015									2015							
	2016									2016							

Figure 180. Striped Anchovy geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

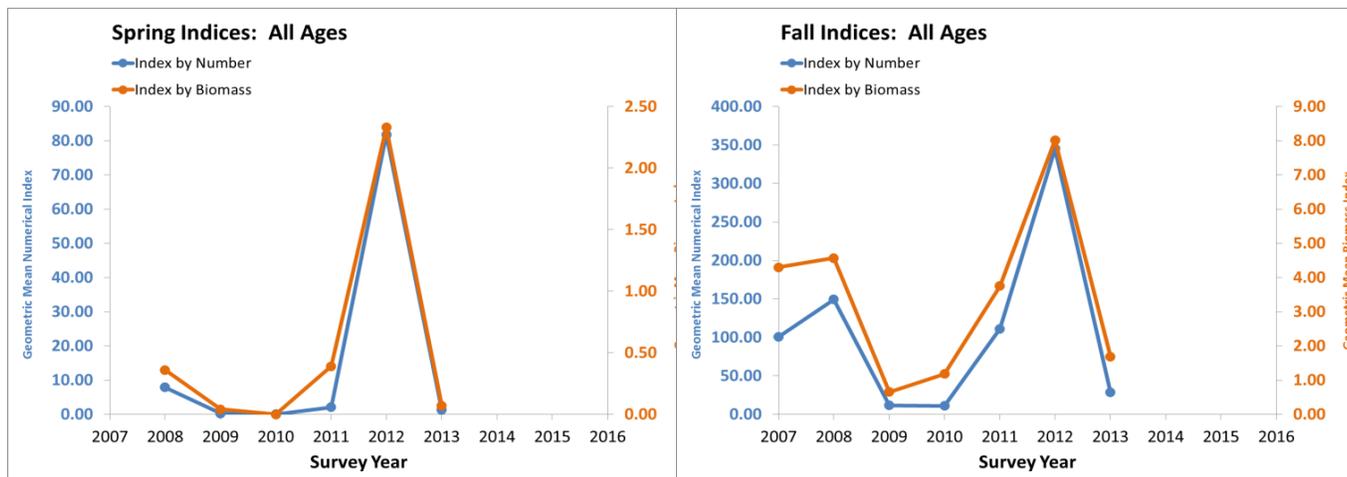
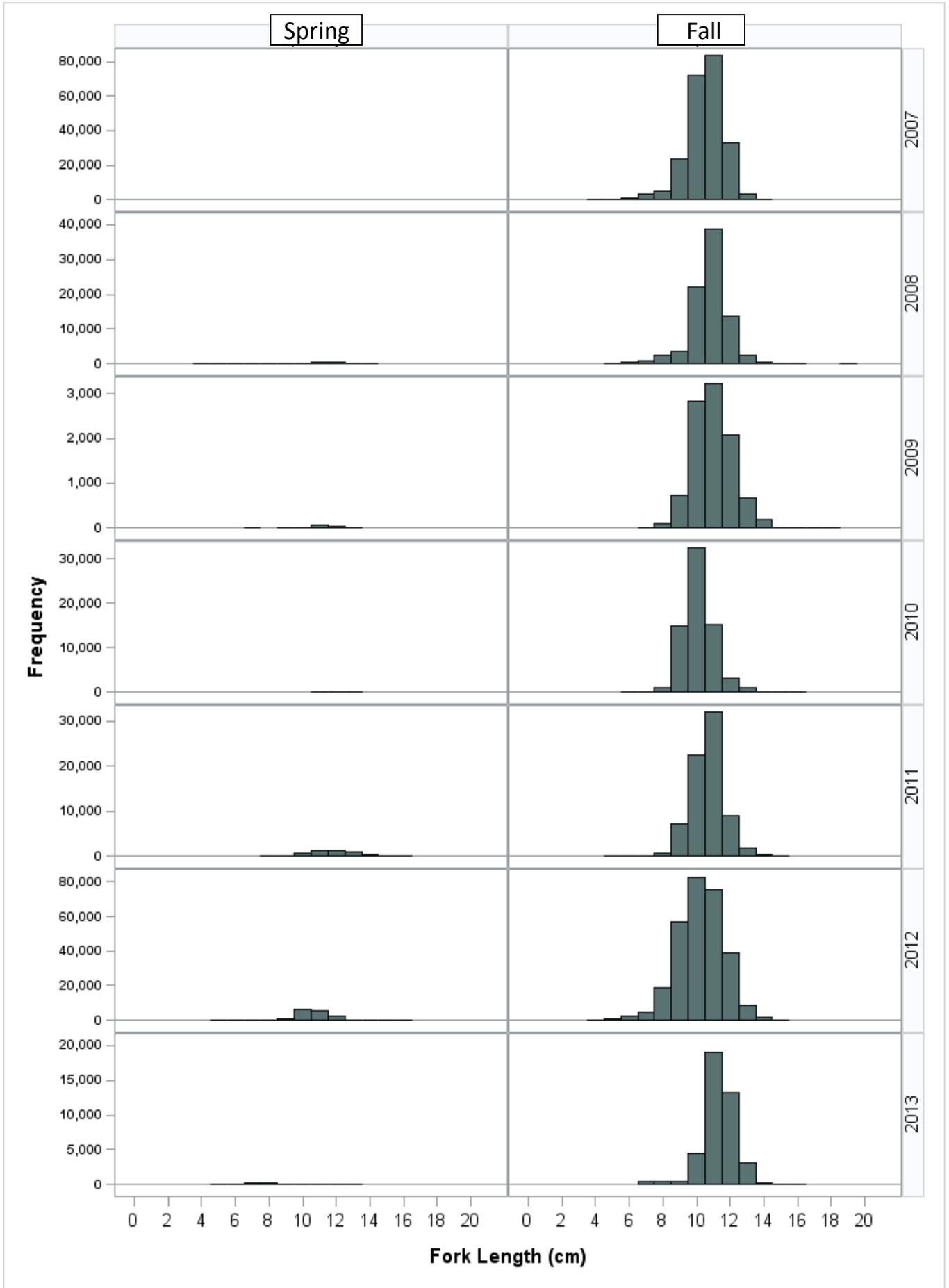


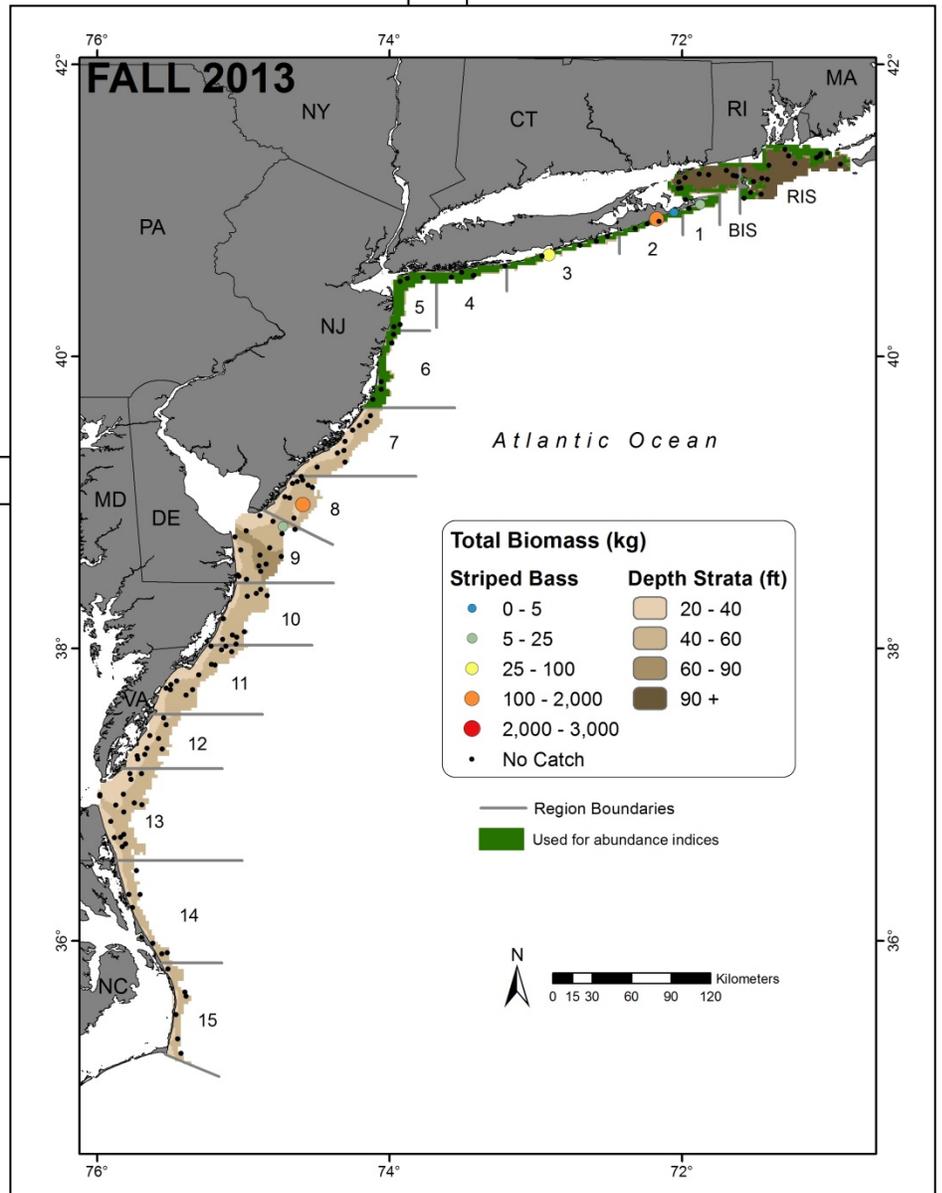
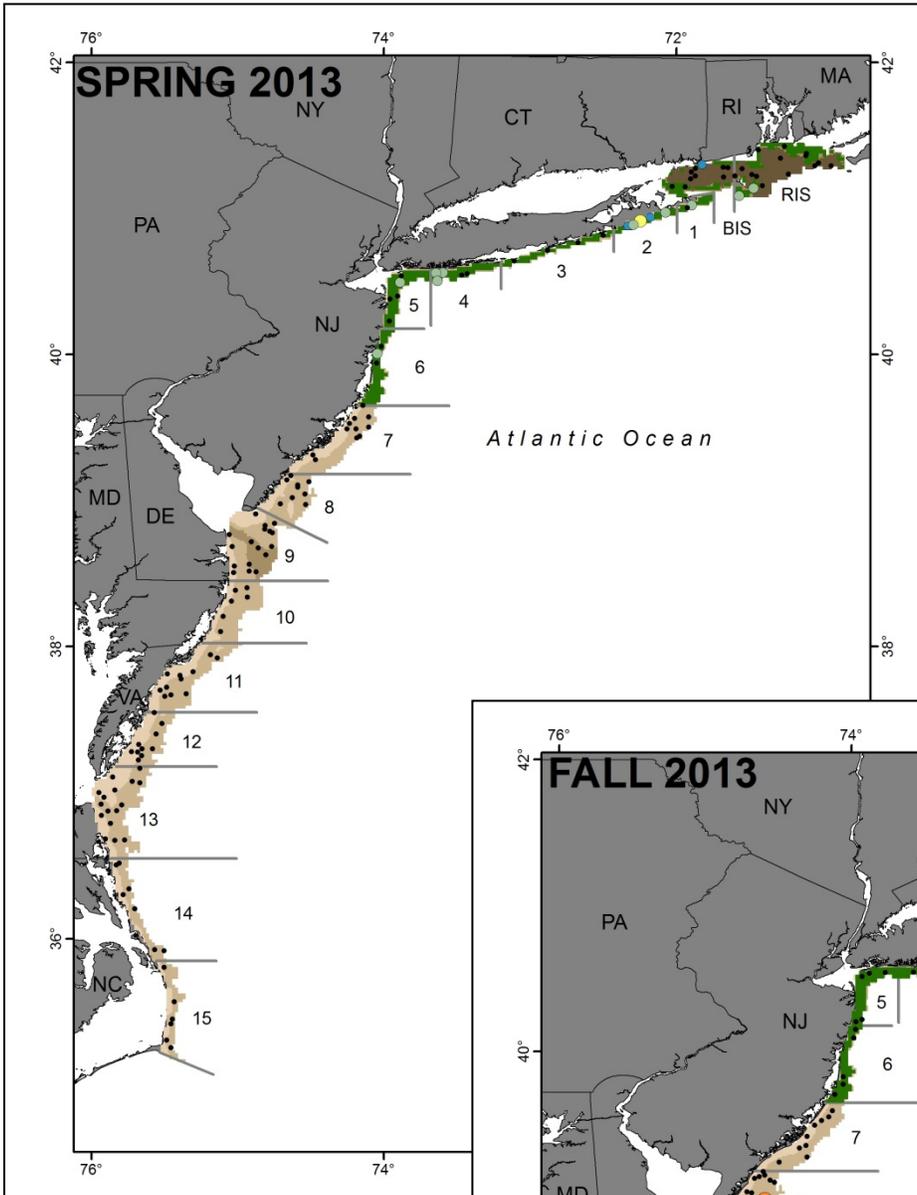
Figure 181. Striped Anchovy length-frequency distributions, by cruise.



Striped Bass

Sampling Priority: A

Figure 182. Striped Bass biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
MD	10	20-40		
	10	40-60		
VA	11	20-40		
	11	40-60		
	11	60-90		
NC	12	20-40		
	12	40-60		
	12	60-90		
NC	13	20-40		
	13	40-60		
	13	60-90		
NC	14	20-40		
	14	40-60		
	14	60-90		
NC	15	20-40		
	15	40-60		
	15	60-90		

= used for abundance indices
 = not used for abundance indices

Table 64. Striped Bass sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	40	171.1	40	39	40	33	32
	2009	162	389.3	162	78	73	48	46
	2010	32	143.2	32	25	25	17	17
	2011	43	284.3	43	42	42	23	23
	2012	7	41.7	7	7	7	5	5
	2013	37	148.2	37	36	0	19	19
Fall	2007	17	66.3	17	16	16	16	16
	2008	1,559	4,611.9	95	43	58	21	20
	2009	352	1,530.4	127	32	31	22	21
	2010	814	2,853.2	59	33	33	29	29
	2011	153	721.9	63	12	12	8	8
	2012	14	114.6	14	14	14	3	3
	2013	113	621.8	113	21	0	10	0

Table 65. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey						Fall Survey											
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI			
All	2007								All	2007	37	0.00	0.20	0.45	0.00	0.41	0.97
	2008	36	0.30	0.63	1.05	0.71	1.59	2.92		2008	36	0.17	1.13	2.89	0.44	1.90	4.84
	2009	42	0.35	0.85	1.55	0.68	1.62	3.09		2009	42	0.05	0.15	0.26	0.08	0.31	0.60
	2010	36	0.04	0.30	0.64	0.13	0.64	1.39		2010	36	0.02	0.72	1.89	0.27	1.38	3.47
	2011	36	0.19	0.41	0.68	0.51	1.06	1.82		2011	36	0.00	0.12	0.27	0.00	0.27	0.67
	2012	36	0.00	0.08	0.15	0.00	0.26	0.61		2012	36	0.01	0.14	0.28	0.05	0.40	0.86
	2013	35	0.10	0.25	0.43	0.20	0.68	1.37		2013	37	0.00	0.12	0.27	0.00	0.22	0.49
	2014									2014							
	2015									2015							
	2016									2016							

Figure 183. Striped Bass geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

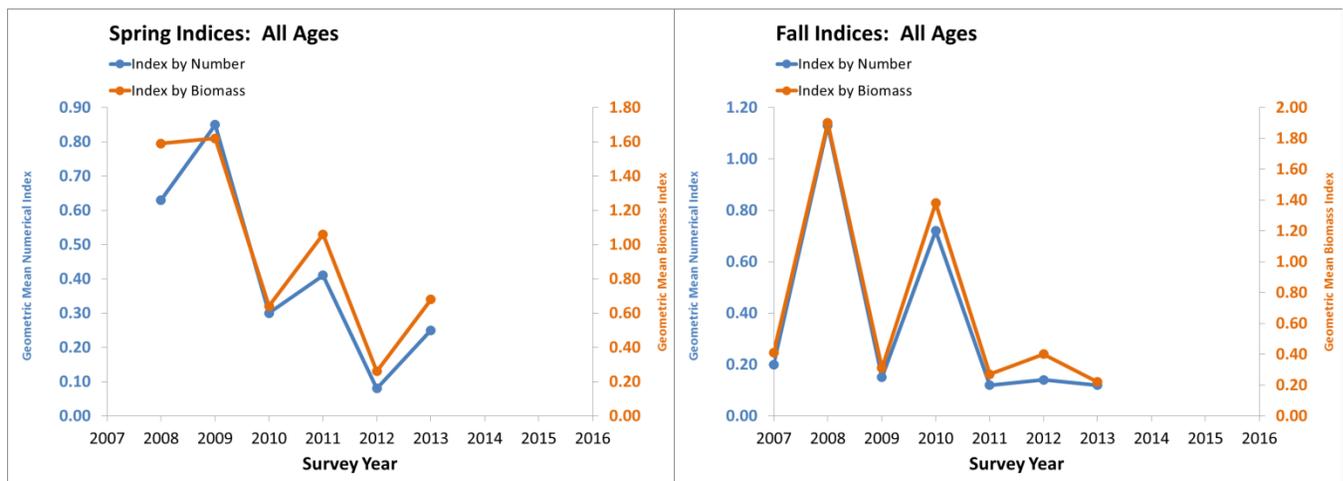


Figure 184. Striped Bass length-frequency distributions, by cruise.

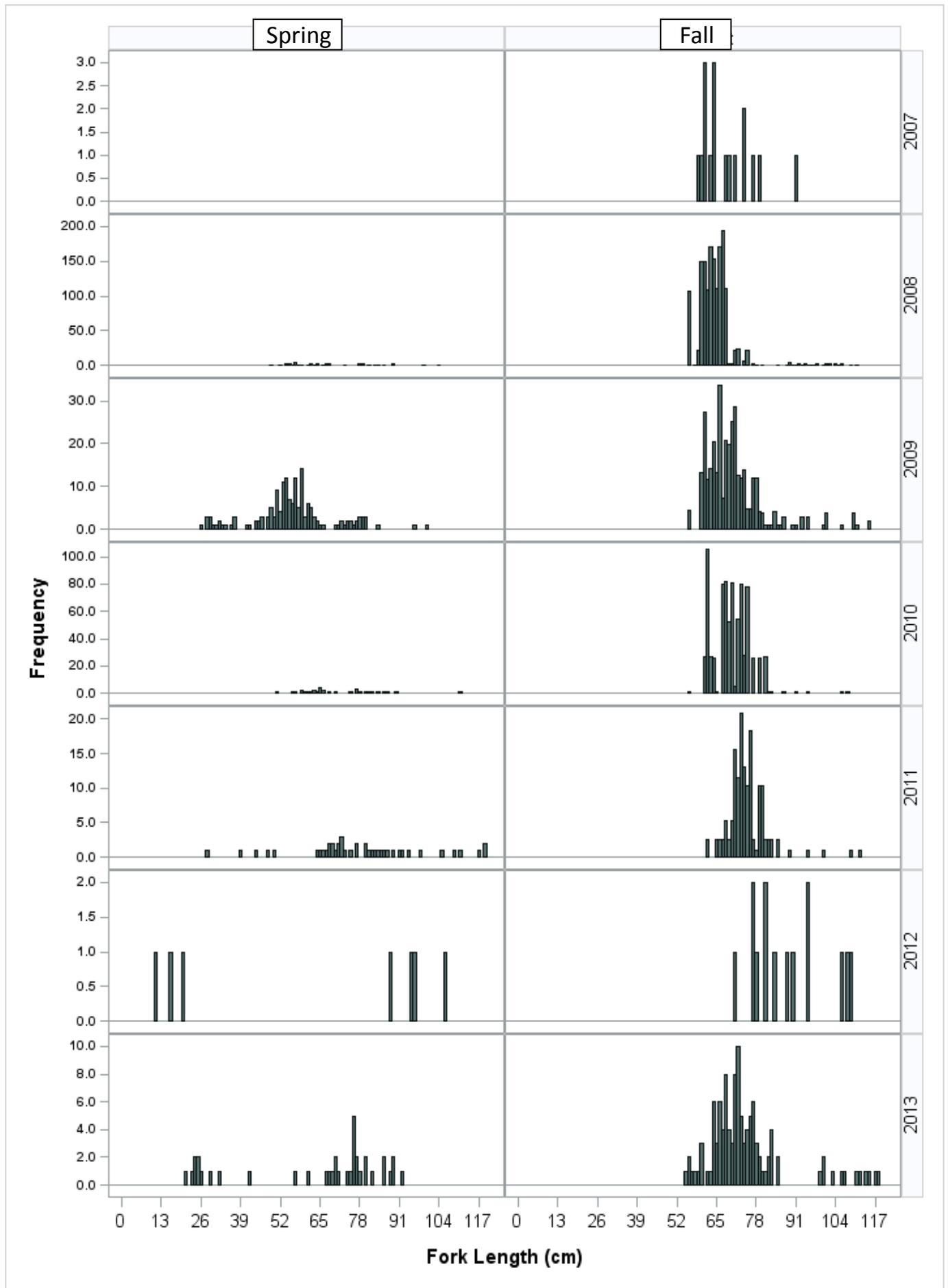


Figure 185. Striped Bass length-frequency distributions, by cruise and sex.

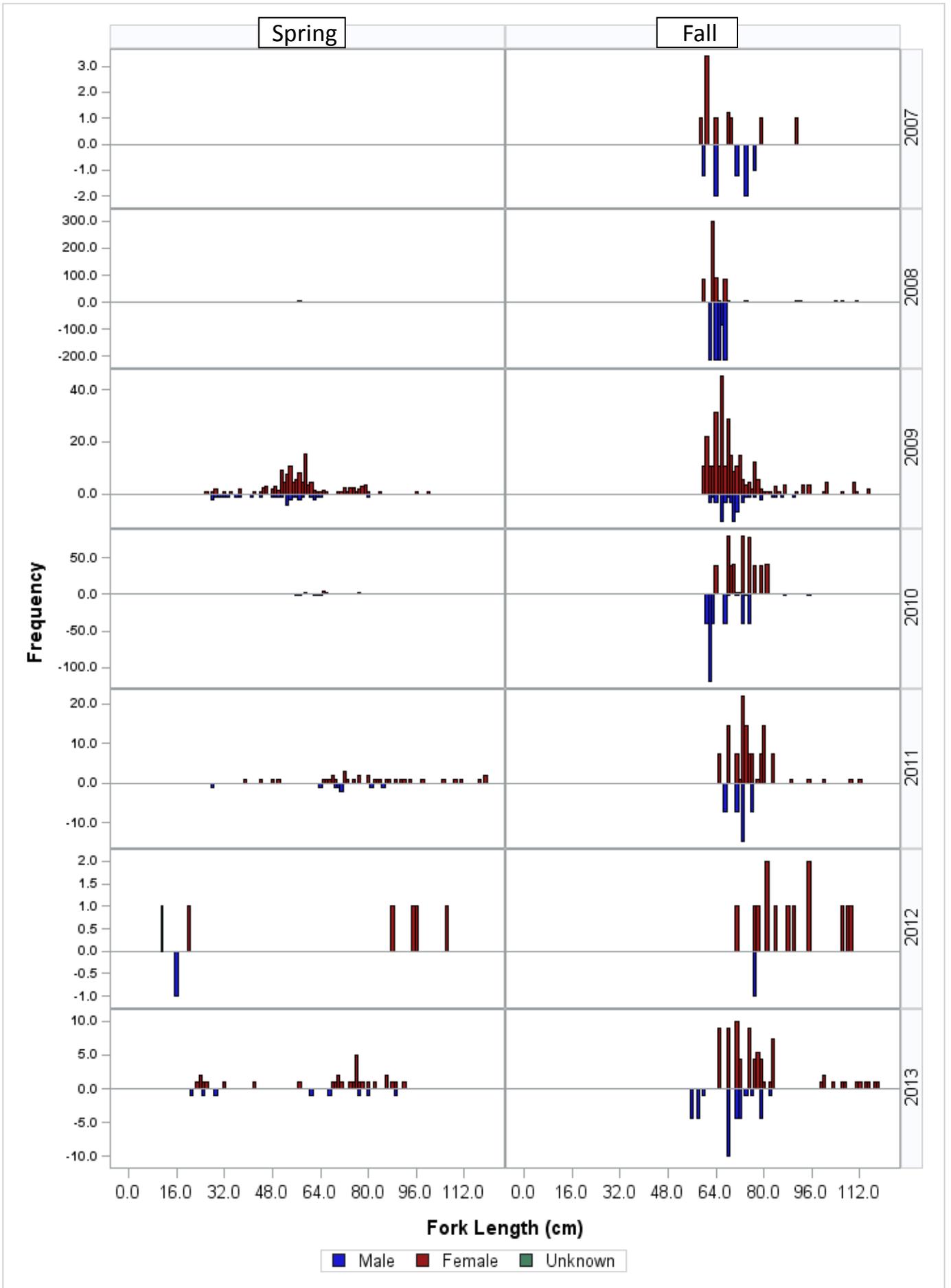


Figure 186. Striped Bass sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

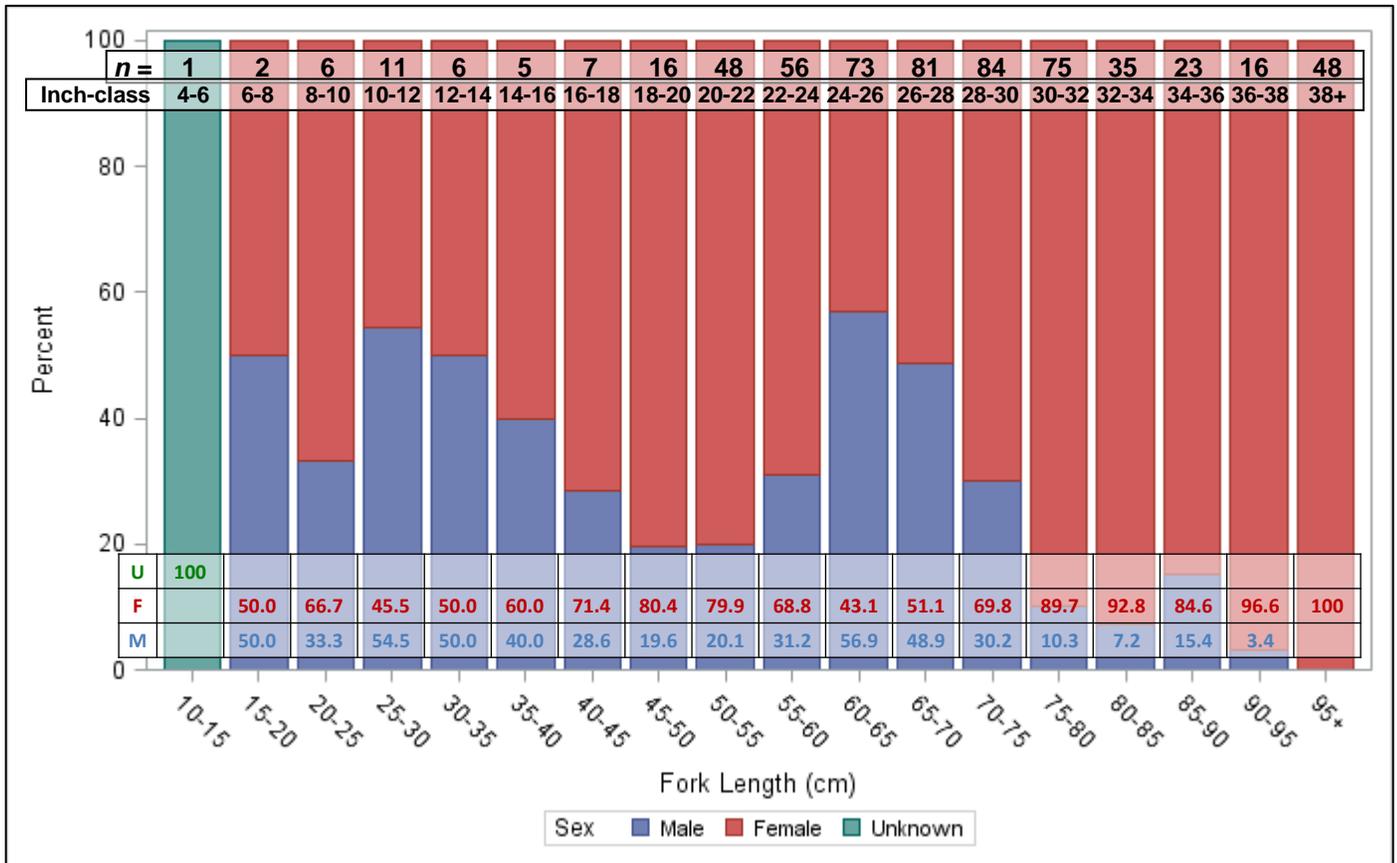


Figure 187. Striped Bass maturity at length, by sex for all cruises pooled, 2007-2013.

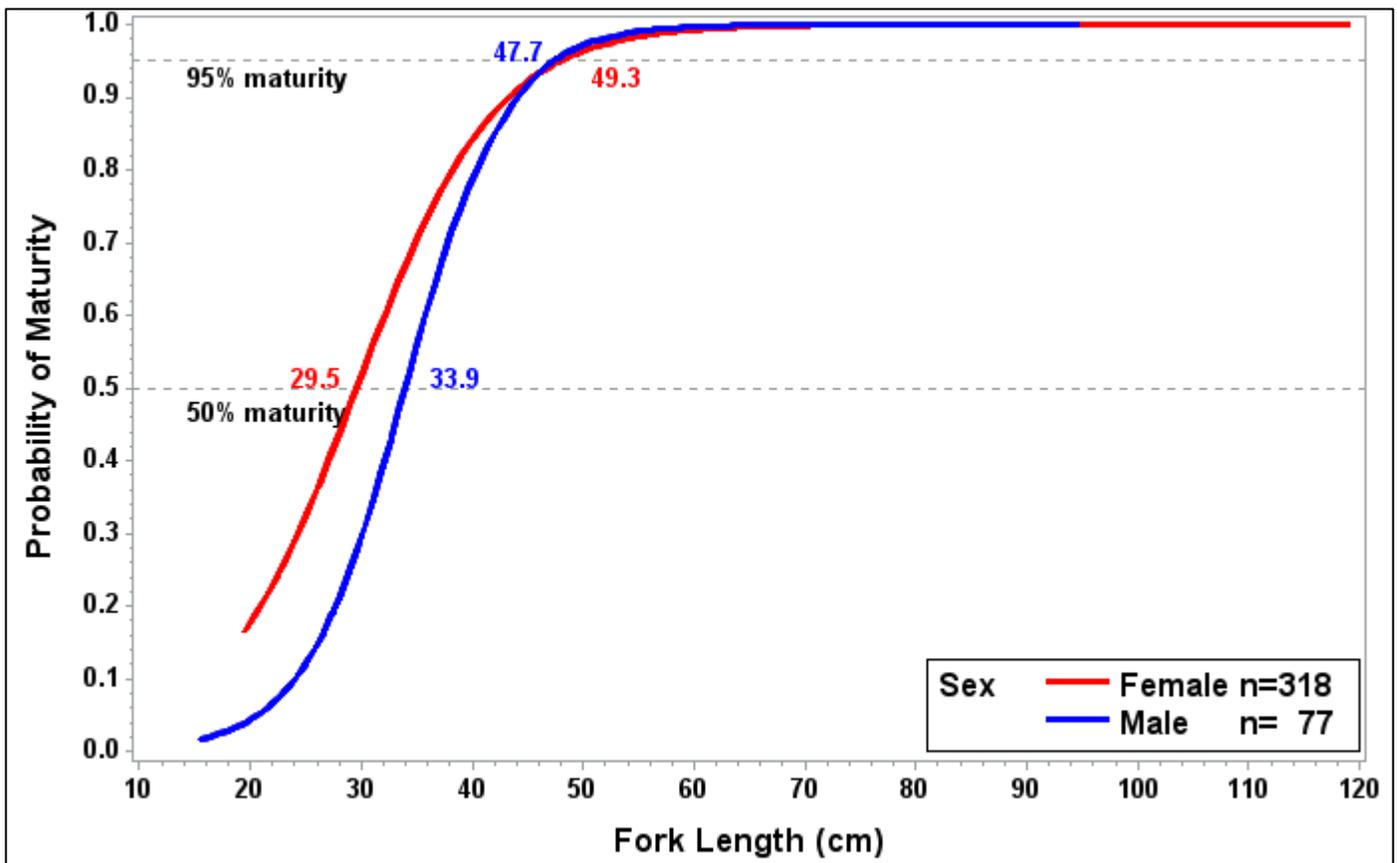
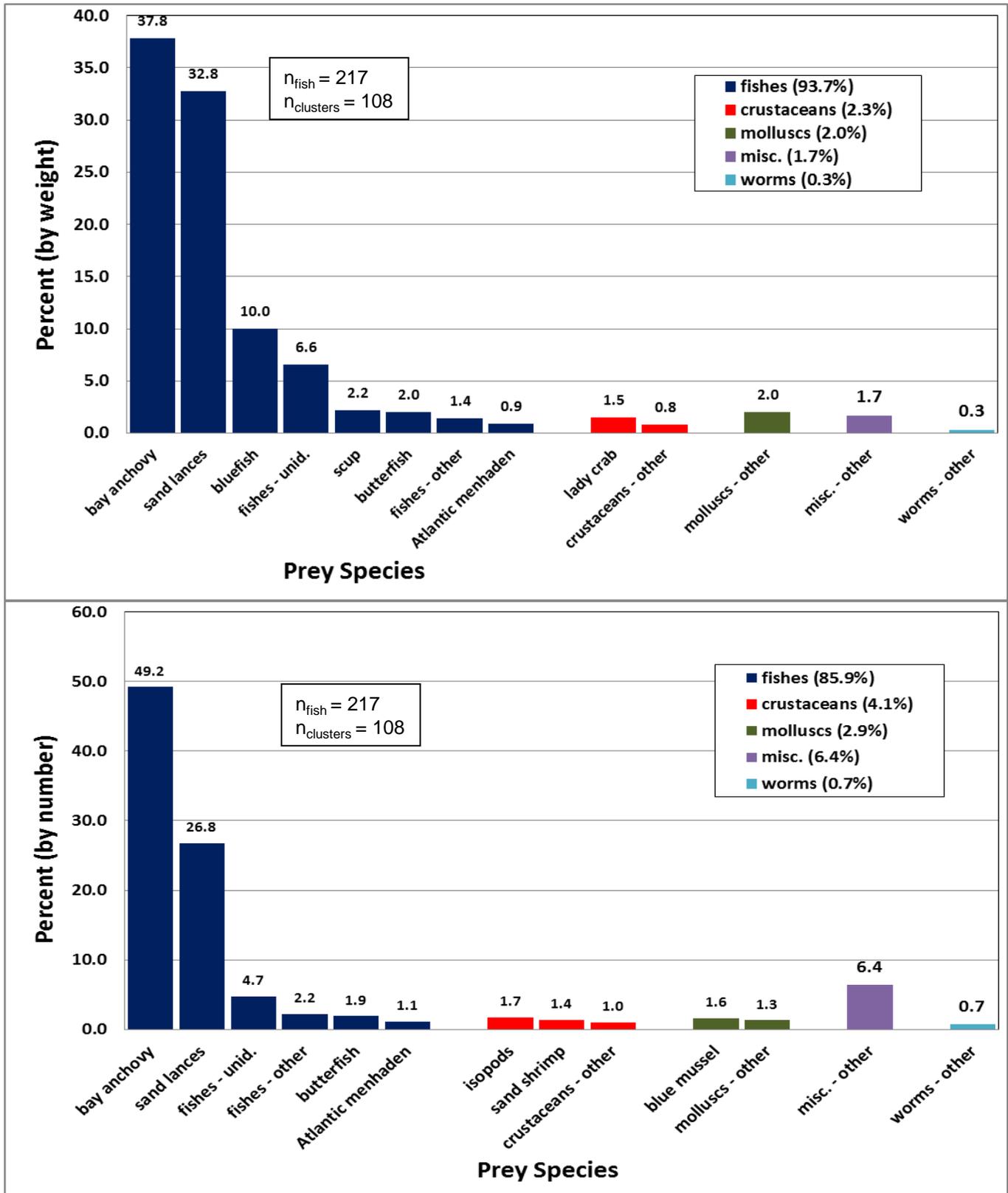
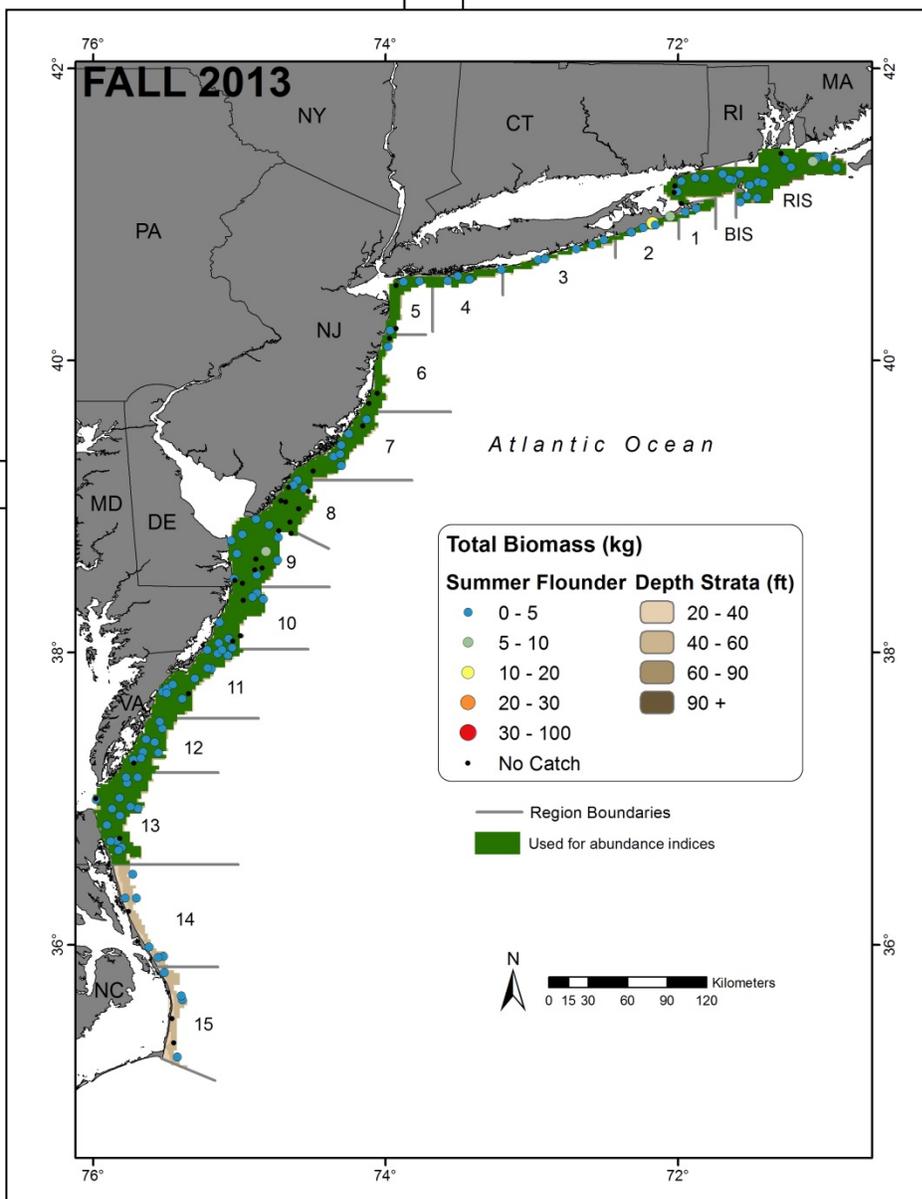
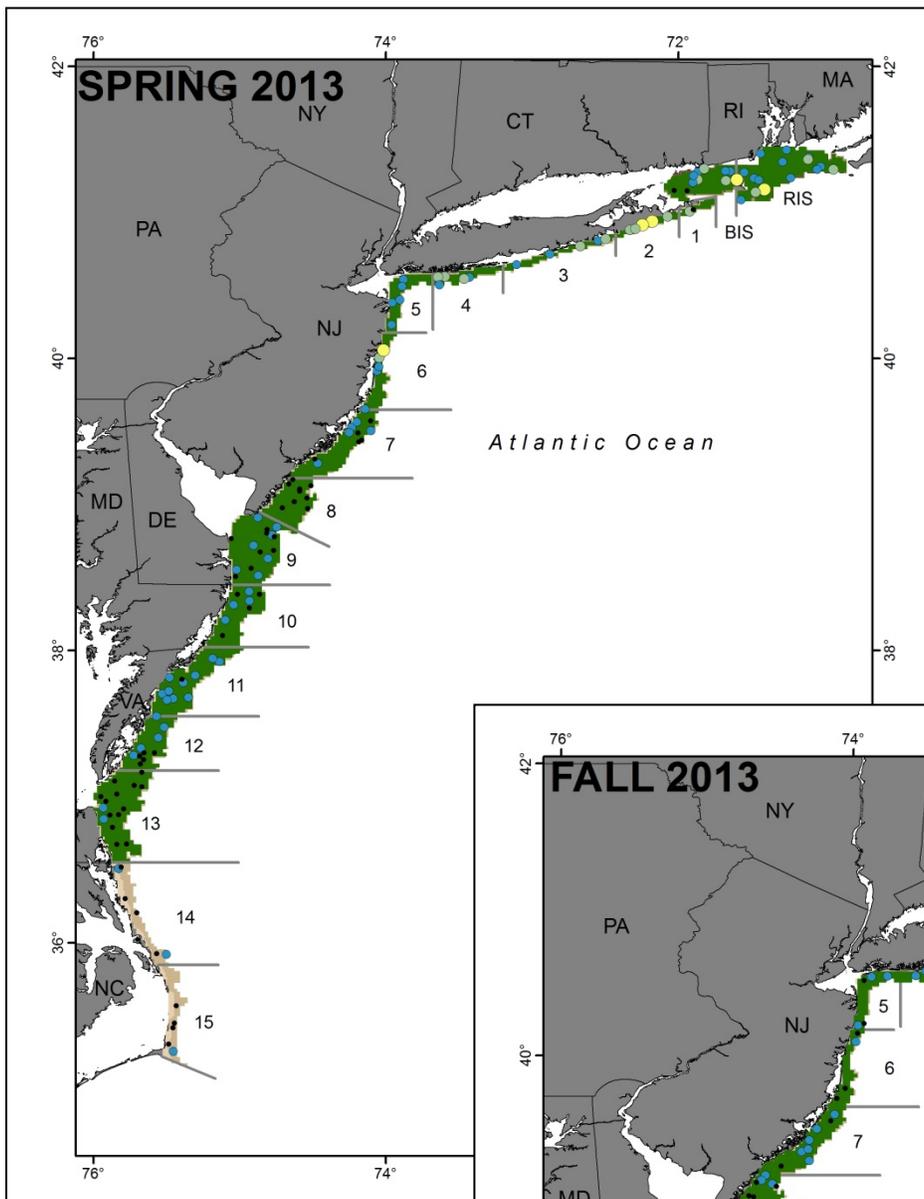
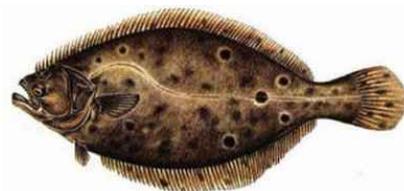


Figure 188. Striped Bass diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Summer Flounder Sampling Priority: A

Figure 189. Summer Flounder biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
MD	10	20-40		
	10	40-60		
VA	11	20-40		
	12	40-60		
	12	20-40		
NC	14	20-40		
	14	40-60		
NC	15	20-40		
	15	40-60		

Total Biomass (kg)

Summer Flounder Depth Strata (ft)

- 0 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- 30 - 100
- No Catch
- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

— Region Boundaries
 Used for abundance indices

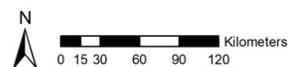


Table 66. Summer Flounder sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	768	527.0	768	522	522	375	366
	2009	977	519.3	977	623	623	363	349
	2010	705	382.8	705	493	493	310	265
	2011	1,352	636.4	1,246	547	547	254	248
	2012	427	263.3	427	263	263	118	112
	2013	520	271.7	520	303	0	155	147
Fall	2007	957	625.4	923	713	713	446	438
	2008	683	418.0	676	440	440	311	304
	2009	1,117	545.8	1,117	745	745	536	527
	2010	826	400.1	806	607	607	403	391
	2011	500	314.2	500	403	403	226	216
	2012	759	508.0	759	561	561	312	296
	2013	335	142.9	335	303	0	158	0

Table 67. Summer Flounder geometric mean indices of abundance, for all specimens captured (by number and biomass) and by age-class for spring and fall NEAMAP surveys.

Spring Survey							Fall Survey										
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								2007	137	3.65	4.22	4.87	2.21	2.60	3.04	
	2008	137	2.58	3.05	3.59	1.61	1.90	2.23	2008	137	2.23	2.71	3.26	1.40	1.67	1.98	
	2009	145	2.08	2.51	3.00	1.23	1.49	1.78	2009	145	4.15	4.99	5.96	2.07	2.43	2.83	
	2010	137	1.83	2.26	2.75	1.04	1.27	1.52	2010	137	3.39	3.99	4.66	1.69	2.00	2.36	
	2011	137	2.66	3.17	3.75	1.38	1.64	1.92	2011	137	2.14	2.54	2.99	1.23	1.49	1.78	
	2012	137	0.86	1.07	1.31	0.62	0.77	0.93	2012	137	2.81	3.29	3.82	1.56	1.84	2.14	
	2013	137	1.13	1.34	1.57	0.69	0.81	0.94	2013	137	1.25	1.51	1.80	0.52	0.62	0.74	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								2007	137	0.62	0.76	0.92	0.15	0.20	0.24	
	2008	137	0.00	0.00	0.00	0.00	0.00	0.00	2008	137	0.33	0.46	0.61	0.07	0.11	0.15	
	2009	145	0.00	0.00	0.00	0.00	0.00	0.00	2009	145	1.11	1.42	1.78	0.23	0.30	0.37	
	2010	137	0.00	0.00	0.00	0.00	0.00	0.00	2010	137	0.87	1.10	1.36	0.21	0.27	0.33	
	2011	137	0.00	0.00	0.00	0.00	0.00	0.00	2011	137	0.34	0.45	0.56	0.08	0.10	0.12	
	2012	137	0.00	0.00	0.00	0.00	0.00	0.00	2012	137	0.23	0.31	0.39	0.02	0.03	0.04	
	2013	137	0.00	0.00	0.00	0.00	0.00	0.00	2013	137	0.35	0.44	0.53	0.06	0.07	0.08	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007								2007	137	1.25	1.47	1.72	0.51	0.62	0.73	
	2008	137	0.56	0.70	0.86	0.18	0.22	0.27	2008	137	0.84	1.04	1.27	0.42	0.53	0.64	
	2009	145	0.66	0.85	1.06	0.18	0.24	0.30	2009	145	1.04	1.25	1.49	0.45	0.54	0.64	
	2010	137	0.58	0.78	1.00	0.17	0.23	0.29	2010	137	1.11	1.32	1.55	0.45	0.54	0.63	
	2011	137	0.77	0.97	1.19	0.24	0.30	0.36	2011	137	0.70	0.86	1.03	0.33	0.40	0.48	
	2012	137	0.16	0.24	0.33	0.05	0.08	0.12	2012	137	0.44	0.55	0.67	0.10	0.12	0.14	
	2013	137	0.23	0.31	0.39	0.05	0.06	0.08	2013	137	0.40	0.52	0.64	0.13	0.17	0.21	
	2014								2014								
	2015								2015								
	2016								2016								
2	2007								2007	137	0.52	0.62	0.73	0.35	0.42	0.49	
	2008	137	0.98	1.15	1.34	0.54	0.63	0.73	2008	137	0.70	0.85	1.02	0.49	0.60	0.73	
	2009	145	0.67	0.83	0.99	0.37	0.44	0.53	2009	145	0.83	0.98	1.15	0.61	0.72	0.84	
	2010	137	0.74	0.89	1.06	0.35	0.43	0.51	2010	137	0.66	0.79	0.94	0.44	0.54	0.65	
	2011	137	1.19	1.43	1.70	0.56	0.67	0.79	2011	137	0.53	0.65	0.77	0.34	0.42	0.50	
	2012	137	0.35	0.46	0.57	0.17	0.24	0.30	2012	137	0.70	0.83	0.98	0.36	0.43	0.50	
	2013	137	0.36	0.45	0.55	0.16	0.21	0.26	2013	137	0.26	0.33	0.41	0.14	0.19	0.23	
	2014								2014								
	2015								2015								
	2016								2016								
3	2007								2007	137	0.60	0.71	0.84	0.59	0.71	0.84	
	2008	137	0.34	0.39	0.45	0.23	0.27	0.32	2008	137	0.22	0.27	0.32	0.19	0.24	0.29	
	2009	145	0.41	0.49	0.58	0.33	0.41	0.48	2009	145	0.33	0.40	0.47	0.31	0.39	0.47	
	2010	137	0.34	0.41	0.48	0.23	0.29	0.35	2010	137	0.27	0.33	0.41	0.25	0.32	0.40	
	2011	137	0.62	0.74	0.86	0.41	0.49	0.58	2011	137	0.28	0.34	0.41	0.24	0.30	0.37	
	2012	137	0.22	0.29	0.37	0.16	0.22	0.28	2012	137	0.79	0.93	1.08	0.61	0.72	0.84	
	2013	137	0.34	0.42	0.51	0.24	0.30	0.36	2013	137	0.13	0.17	0.20	0.10	0.12	0.15	
	2014								2014								
	2015								2015								
	2016								2016								

Table 67. cont.

Spring Survey										Fall Survey									
4	2007									4	2007	137	0.27	0.33	0.40	0.33	0.41	0.51	
	2008	137	0.53	0.63	0.75	0.48	0.59	0.71		2008	137	0.09	0.13	0.18	0.12	0.17	0.23		
	2009	145	0.20	0.24	0.28	0.21	0.25	0.30		2009	145	0.20	0.25	0.31	0.25	0.33	0.41		
	2010	137	0.16	0.20	0.25	0.15	0.20	0.24		2010	137	0.07	0.10	0.14	0.10	0.16	0.23		
	2011	137	0.29	0.35	0.41	0.22	0.28	0.34		2011	137	0.16	0.21	0.25	0.19	0.25	0.31		
	2012	137	0.13	0.18	0.22	0.11	0.15	0.19		2012	137	0.42	0.51	0.59	0.44	0.54	0.65		
	2013	137	0.25	0.31	0.37	0.20	0.24	0.29		2013	137	0.07	0.10	0.13	0.07	0.10	0.14		
	2014									2014									
2015									2015										
2016									2016										
5	2007									5	2007	137	0.13	0.16	0.20	0.19	0.25	0.31	
	2008	137	0.19	0.24	0.29	0.23	0.28	0.35		2008	137	0.06	0.08	0.10	0.08	0.11	0.14		
	2009	145	0.15	0.18	0.21	0.18	0.22	0.27		2009	145	0.10	0.13	0.15	0.14	0.19	0.24		
	2010	137	0.10	0.13	0.16	0.12	0.16	0.19		2010	137	0.07	0.09	0.11	0.09	0.13	0.18		
	2011	137	0.11	0.15	0.18	0.11	0.15	0.20		2011	137	0.06	0.08	0.10	0.09	0.13	0.16		
	2012	137	0.07	0.10	0.12	0.09	0.12	0.15		2012	137	0.11	0.13	0.16	0.15	0.20	0.25		
	2013	137	0.09	0.11	0.14	0.09	0.12	0.15		2013	137	0.01	0.02	0.03	0.01	0.03	0.05		
	2014									2014									
2015									2015										
2016									2016										
6	2007									6	2007	137	0.06	0.08	0.10	0.10	0.14	0.18	
	2008	137	0.11	0.14	0.18	0.15	0.20	0.25		2008	137	0.03	0.04	0.05	0.04	0.06	0.08		
	2009	145	0.08	0.11	0.13	0.11	0.15	0.19		2009	145	0.05	0.06	0.08	0.08	0.11	0.15		
	2010	137	0.06	0.08	0.10	0.08	0.12	0.15		2010	137	0.03	0.04	0.06	0.05	0.07	0.10		
	2011	137	0.06	0.08	0.10	0.07	0.11	0.15		2011	137	0.03	0.04	0.05	0.05	0.08	0.11		
	2012	137	0.05	0.06	0.08	0.06	0.09	0.12		2012	137	0.05	0.07	0.08	0.08	0.12	0.15		
	2013	137	0.05	0.07	0.08	0.06	0.09	0.12		2013	137	0.01	0.01	0.02	0.01	0.02	0.04		
	2014									2014									
2015									2015										
2016									2016										
7+	2007									7+	2007	137	0.04	0.07	0.10	0.08	0.15	0.22	
	2008	137	0.10	0.13	0.17	0.15	0.21	0.28		2008	137	0.01	0.03	0.05	0.03	0.07	0.12		
	2009	145	0.07	0.09	0.12	0.10	0.15	0.20		2009	145	0.03	0.05	0.08	0.06	0.12	0.17		
	2010	137	0.06	0.08	0.11	0.09	0.13	0.18		2010	137	0.02	0.04	0.06	0.03	0.08	0.12		
	2011	137	0.05	0.07	0.10	0.07	0.12	0.18		2011	137	0.03	0.05	0.08	0.06	0.12	0.19		
	2012	137	0.05	0.08	0.11	0.08	0.15	0.21		2012	137	0.03	0.06	0.08	0.07	0.13	0.19		
	2013	137	0.05	0.07	0.09	0.07	0.11	0.16		2013	137	0.00	0.01	0.01	0.00	0.02	0.03		
	2014									2014									
2015									2015										
2016									2016										

Figure 190. Summer Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

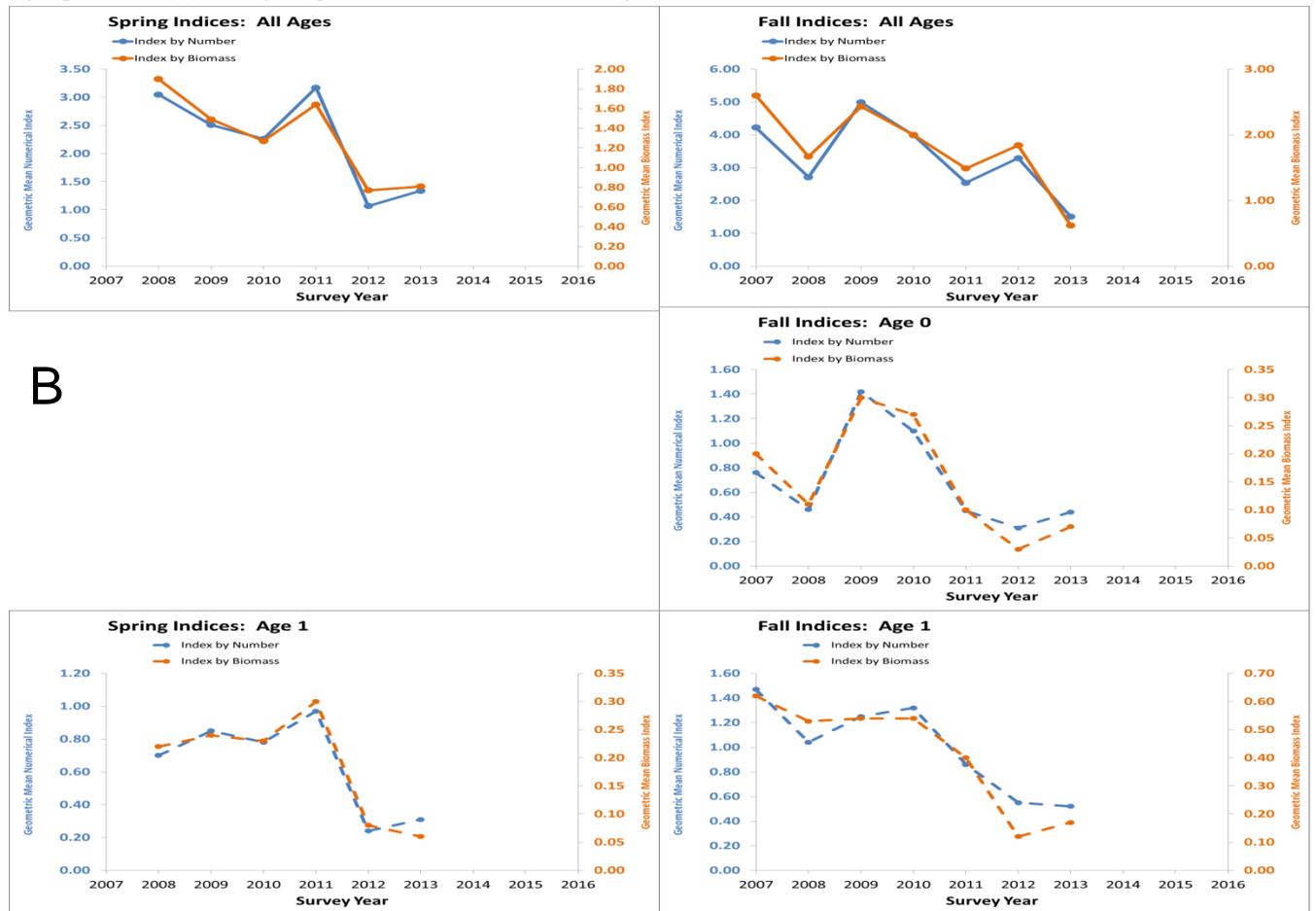


Figure 190. Cont.

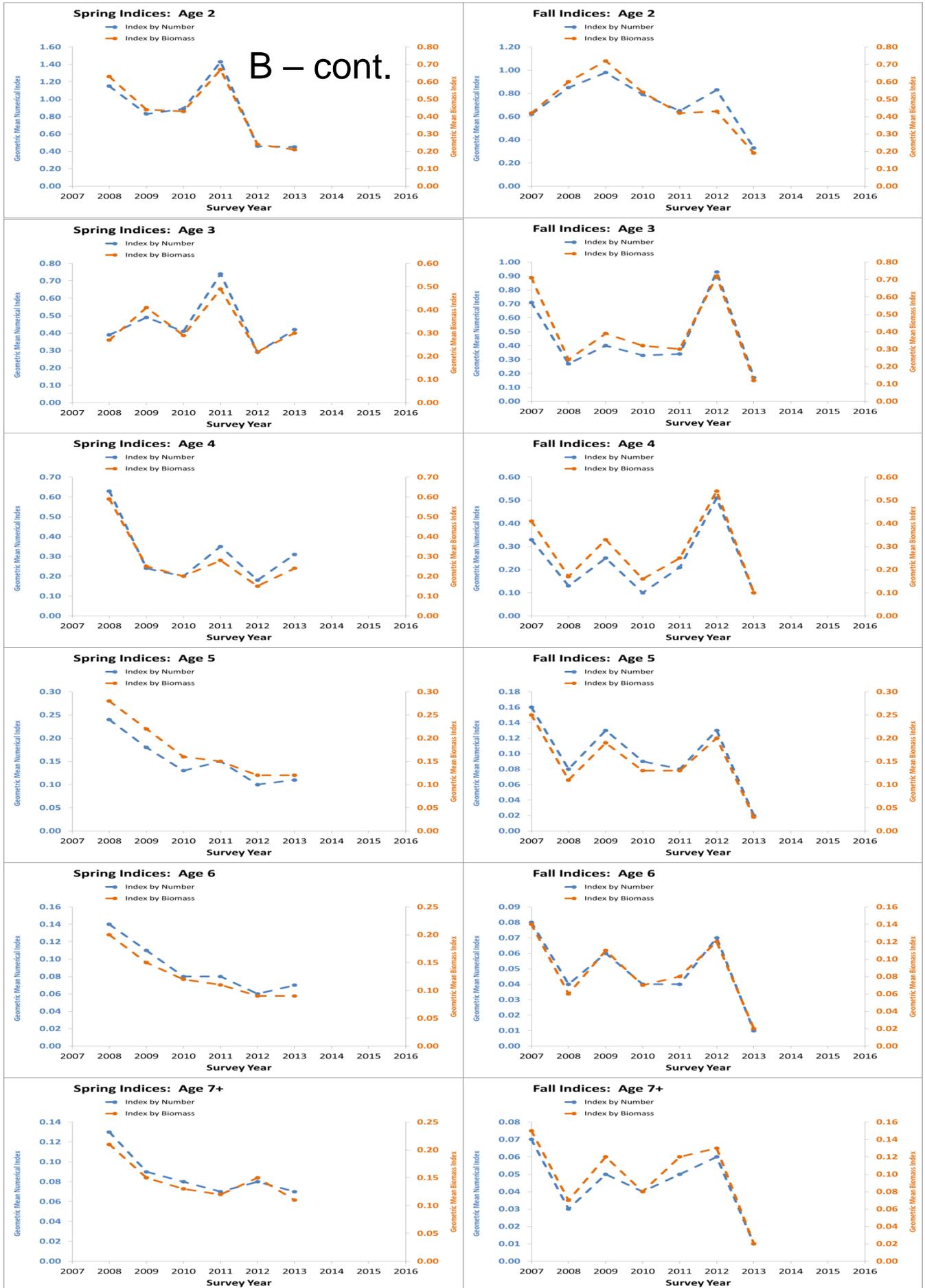


Figure 191. Summer Flounder length-frequency distributions, by cruise.

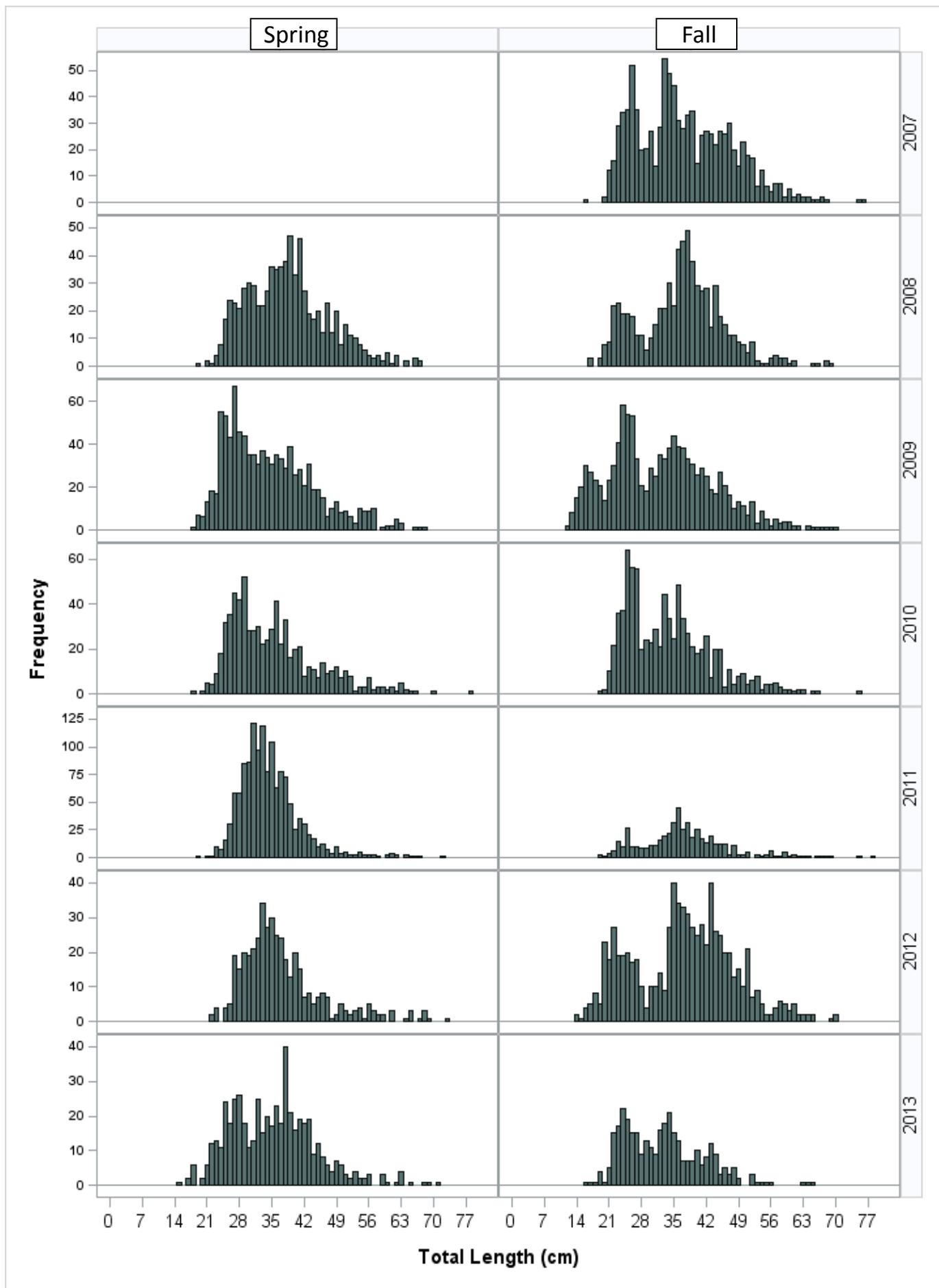


Figure 192. Summer Flounder length-frequency distributions, by cruise and sex.

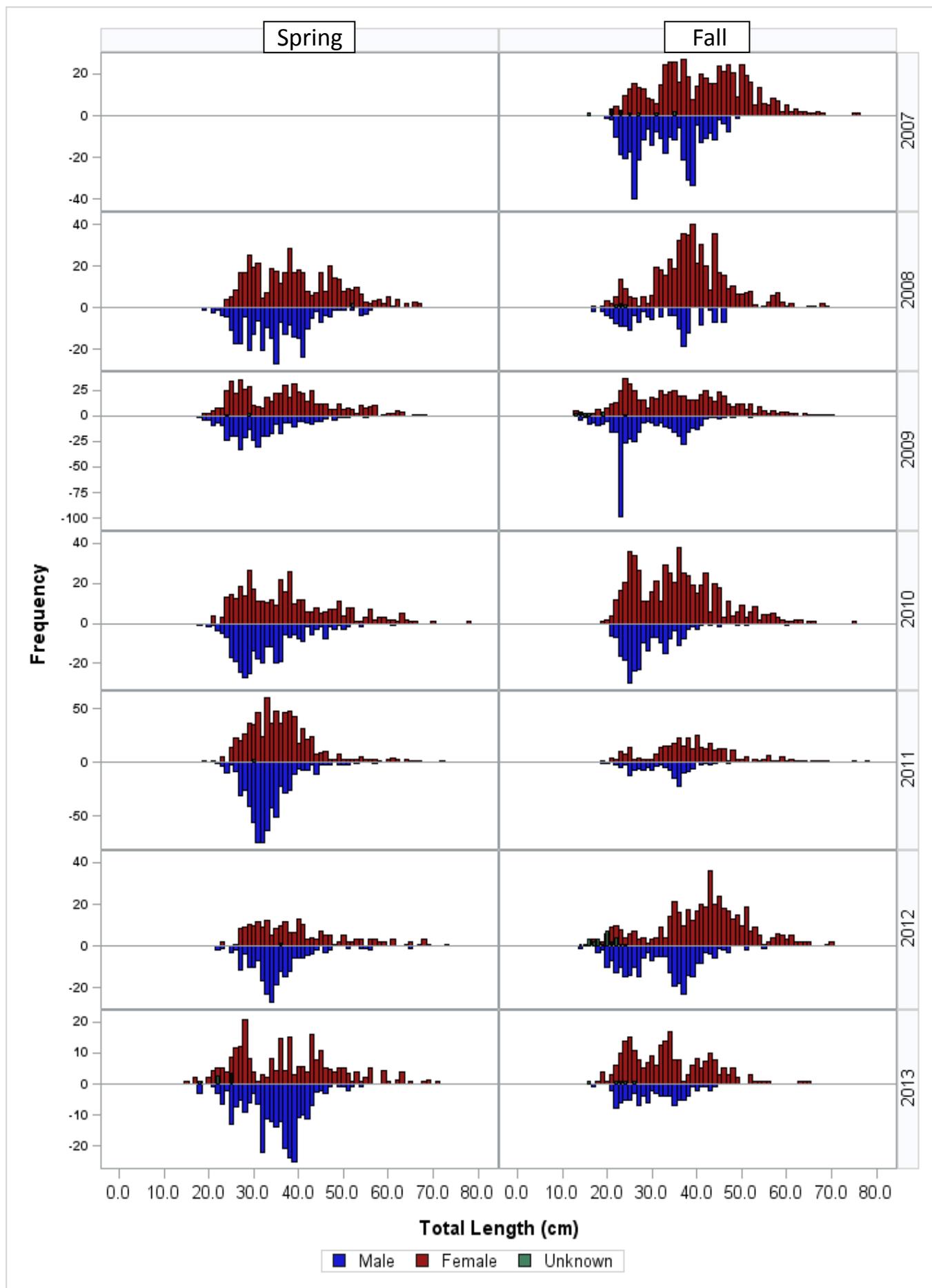


Figure 193. Summer flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

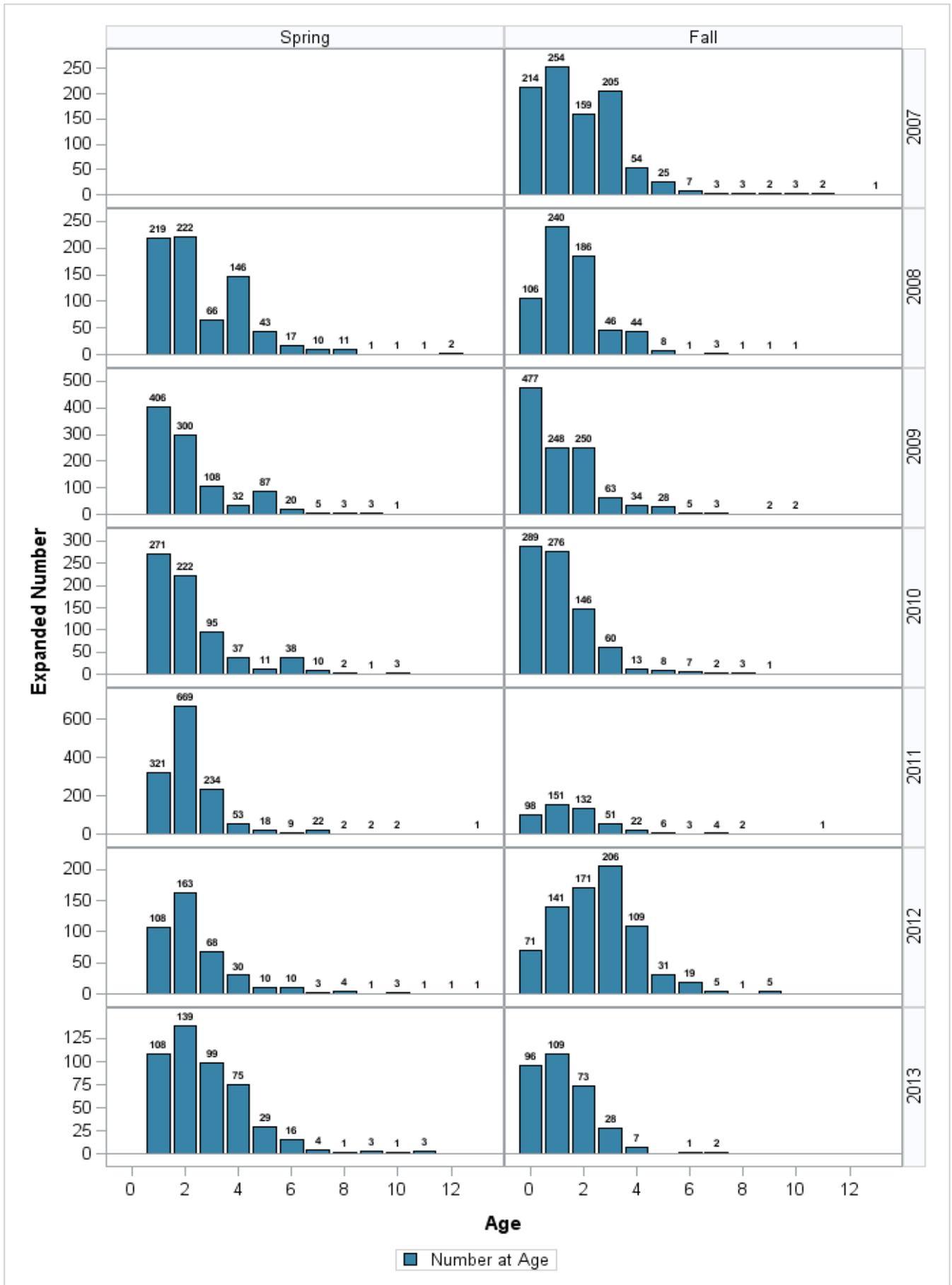


Figure 194. Summer flounder catch-at-age standardized to 3,000 trawl minutes, by cruise..

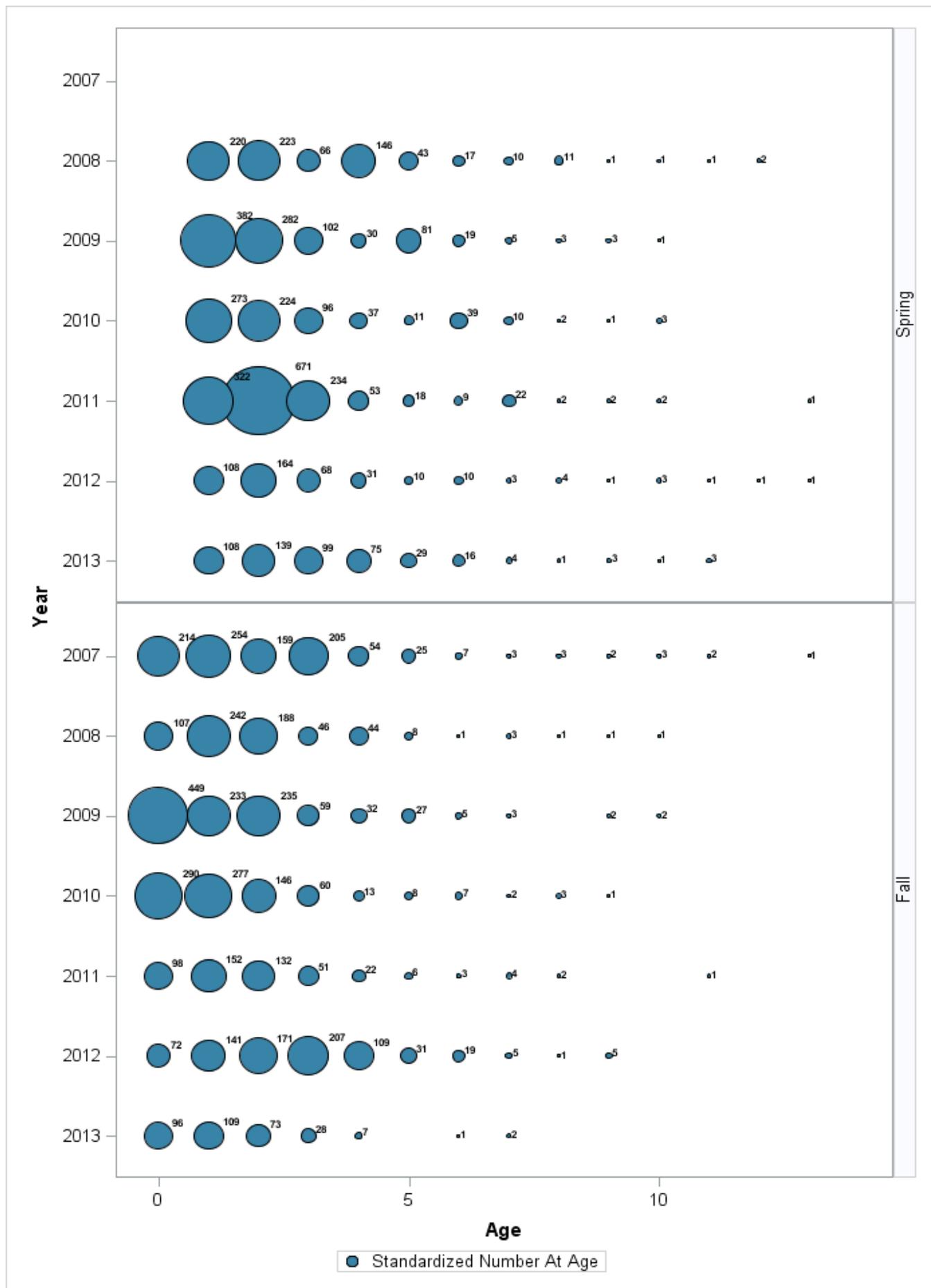


Figure 195. Summer Flounder sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

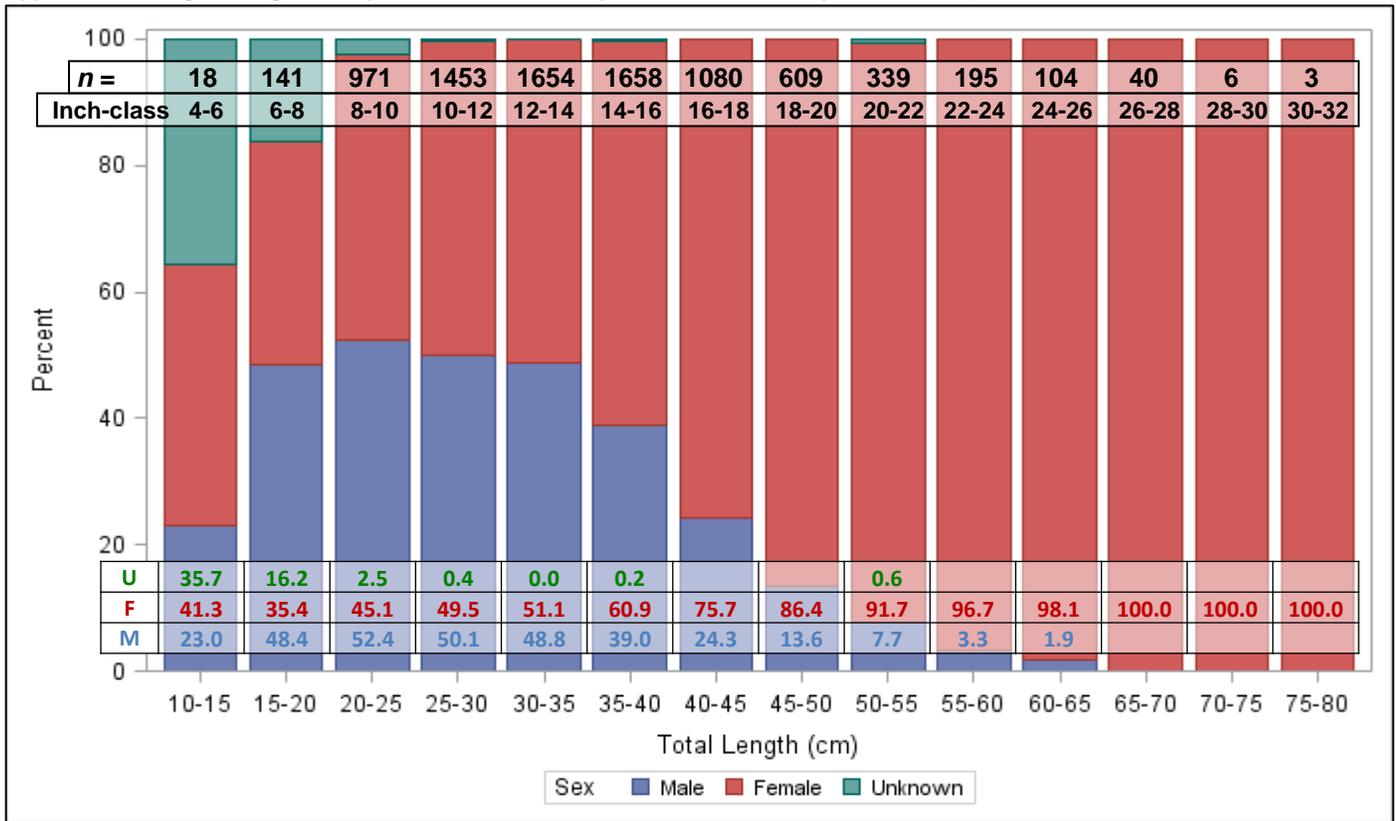


Figure 196. Summer Flounder maturity at length, by sex for all cruises pooled, 2007-2013.

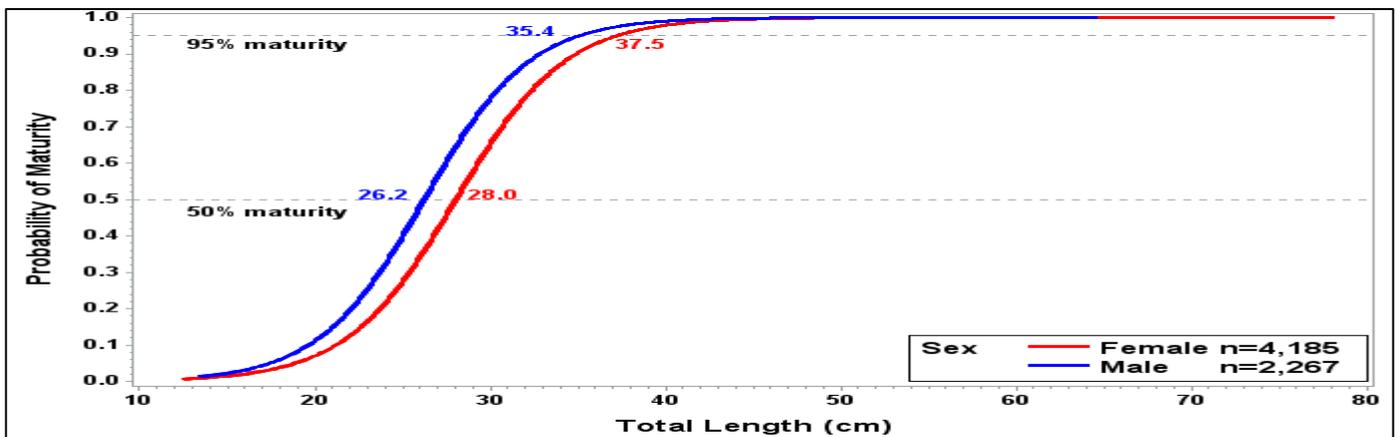


Figure 197. Summer Flounder maturity at age, by sex for all cruises pooled, 2007-2013.

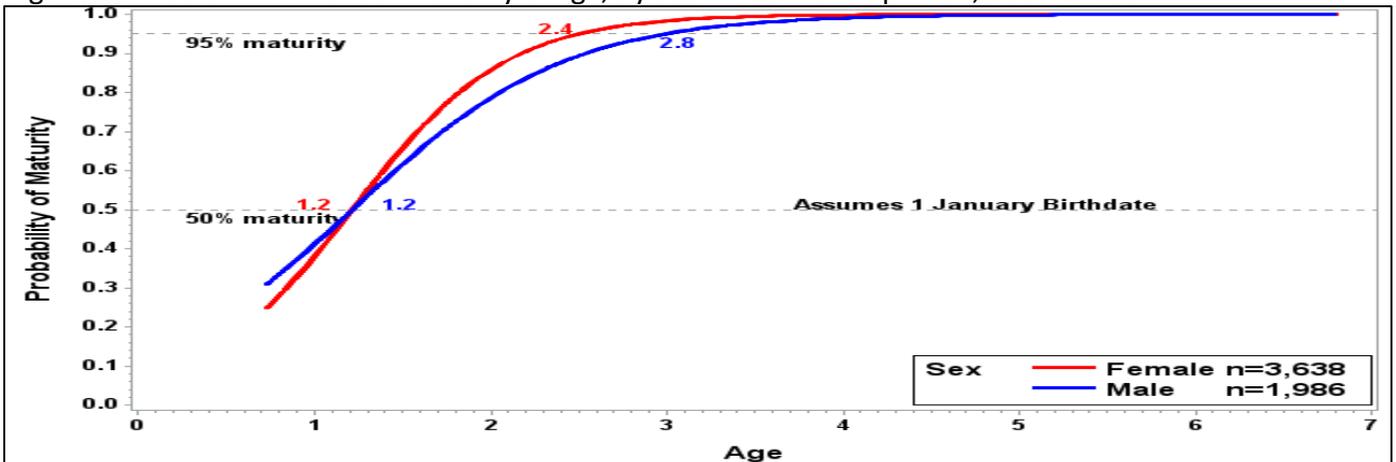
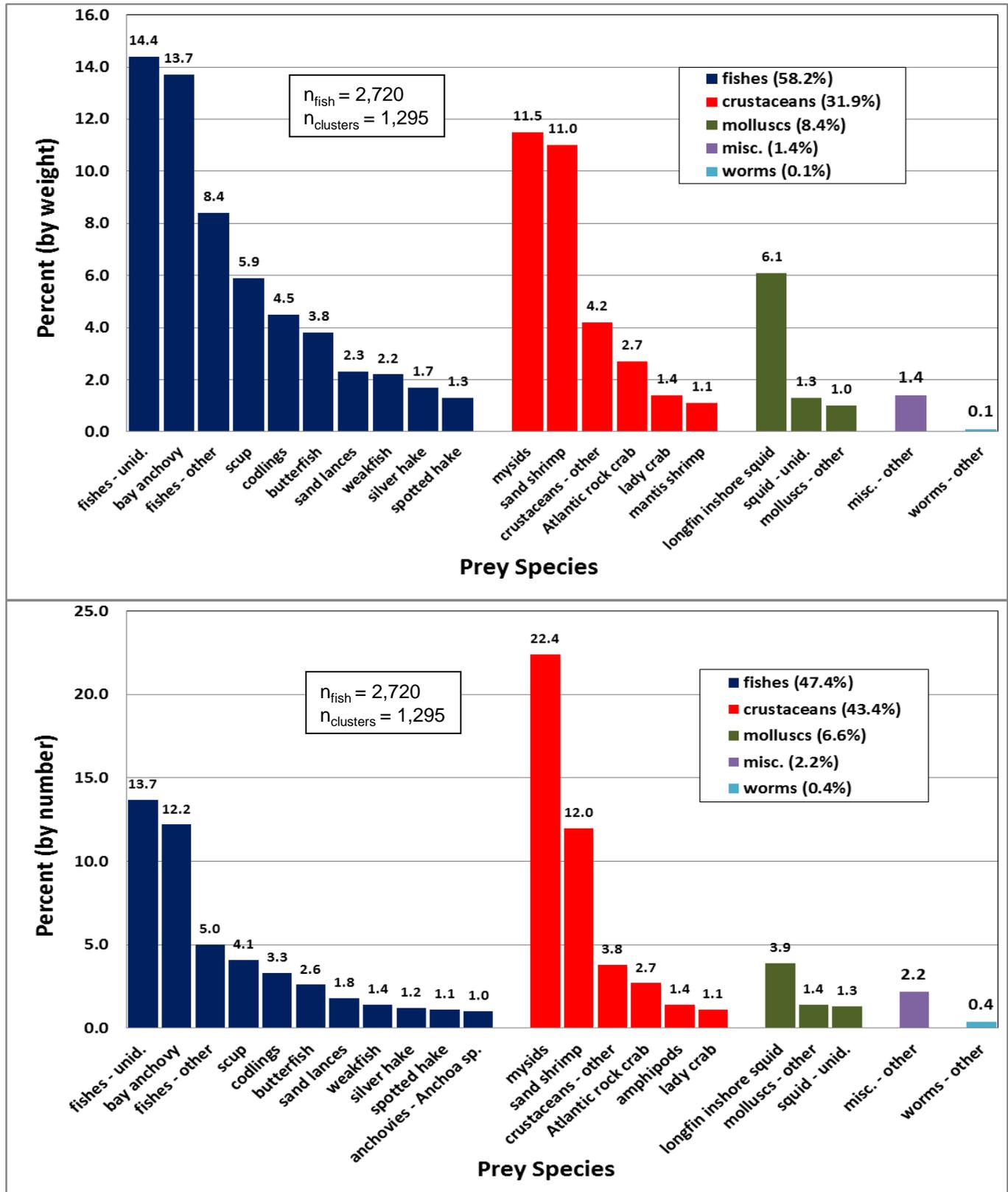


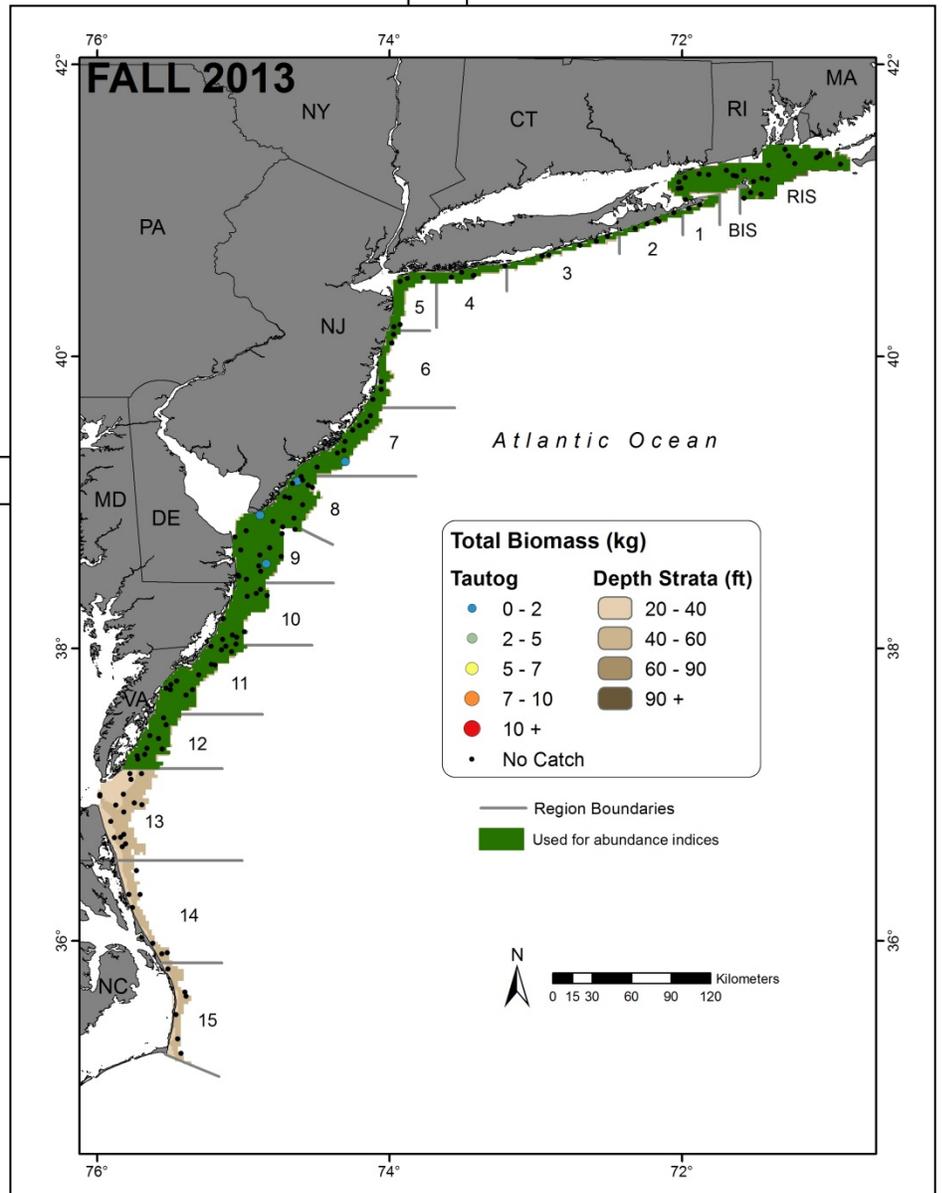
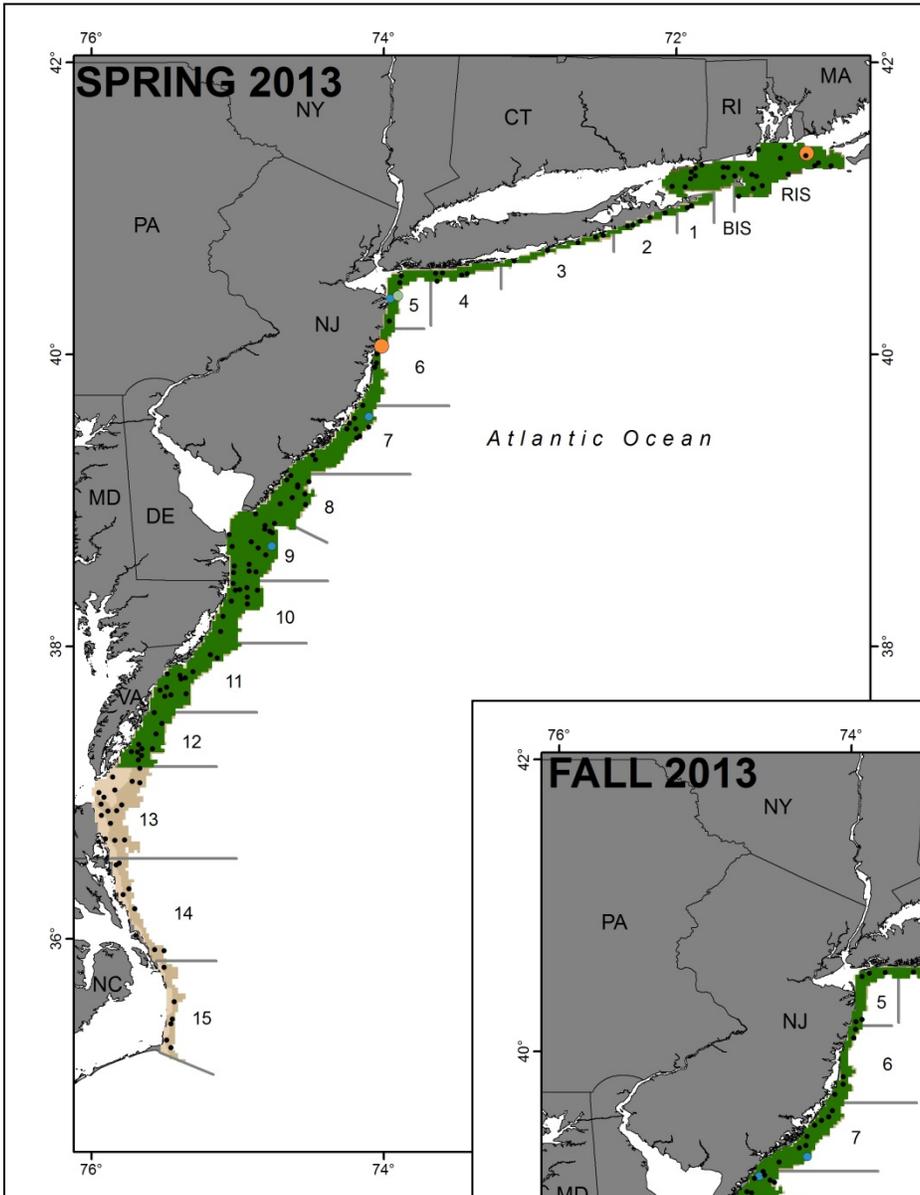
Figure 198. Summer Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Tautog

Sampling Priority: A

Figure 199. Tautog biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	[Green]	[Green]
		90+		
	BIS	60-90	[Green]	[Green]
		90+		
NY	01	40-60	[Green]	[Green]
		20-40		
	02	40-60		
		20-40		
		40-60		
03	20-40			
	40-60			
	20-40			
04	20-40			
	40-60			
	20-40			
05	20-40			
	40-60			
	20-40			
NJ	06	20-40	[Green]	[Green]
		40-60		
	07	20-40		
		40-60		
08	20-40			
	40-60			
	20-40			
DE	09	20-40	[Green]	[Green]
		40-60		
		60-90		
MD	10	20-40	[Green]	[Green]
		40-60		
VA	11	20-40	[Green]	[Green]
		40-60		
		20-40		
12	[Green]	20-40	[Green]	[Green]
		40-60		
		20-40		
13	[Green]	20-40	[Green]	[Green]
		40-60		
		20-40		
NC	14	20-40	[Grey]	[Grey]
		40-60		
		20-40		
15	[Grey]	20-40	[Grey]	[Grey]
		40-60		
		20-40		

[Green] = used for abundance indices
 [Grey] = not used for abundance indices

Table 68. Tautog sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	8	16.0	8	8	0	8	8
	2009	16	31.0	16	15	0	15	15
	2010	14	15.6	14	14	0	12	9
	2011	5	10.5	5	5	0	5	5
	2012	21	21.1	21	13	0	11	11
	2013	17	23.3	17	17	0	13	13
Fall	2007	4	3.7	4	4	0	4	4
	2008	137	59.2	69	27	0	26	26
	2009	39	43.0	39	20	0	19	19
	2010	25	24.3	25	24	0	23	23
	2011	12	11.8	12	12	0	12	0
	2012	37	30.3	37	18	0	16	16
	2013	6	3.5	6	6	0	6	0

Table 69. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

Spring Survey						Fall Survey											
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	119	0.00	0.02	0.05	0.00	0.02	0.05
	2008	119	0.01	0.04	0.07	0.01	0.04	0.07		2008	121	0.02	0.10	0.20	0.03	0.10	0.19
	2009	129	0.01	0.07	0.12	0.02	0.09	0.17		2009	129	0.00	0.08	0.17	0.00	0.07	0.17
	2010	121	0.00	0.06	0.12	0.00	0.06	0.13		2010	121	0.03	0.10	0.16	0.02	0.08	0.15
	2011	121	0.00	0.02	0.05	0.00	0.03	0.08		2011	121	0.00	0.03	0.08	0.00	0.03	0.08
	2012	121	0.00	0.05	0.12	0.00	0.06	0.13		2012	121	0.00	0.06	0.13	0.00	0.05	0.12
	2013	121	0.01	0.06	0.12	0.01	0.07	0.14		2013	121	0.00	0.04	0.07	0.00	0.02	0.05
	2014									2014							
	2015									2015							
	2016									2016							

Figure 200. Tautog geometric mean indices of abundance, for all specimens captured for spring and fall NEAMAP surveys.

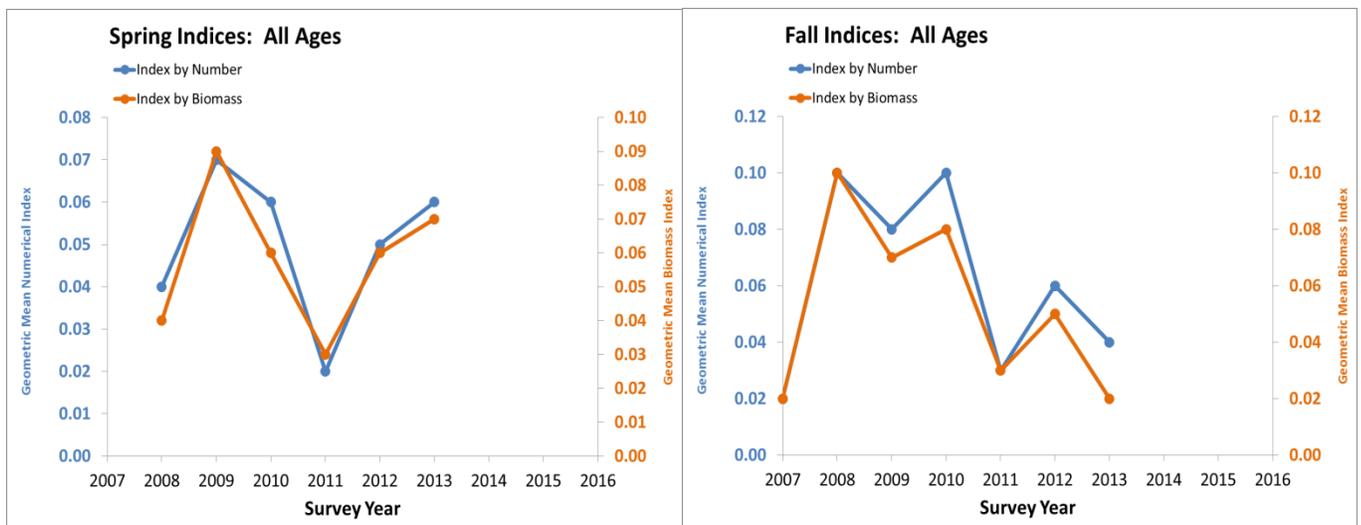


Figure 201. Tautog length-frequency distributions, by cruise.

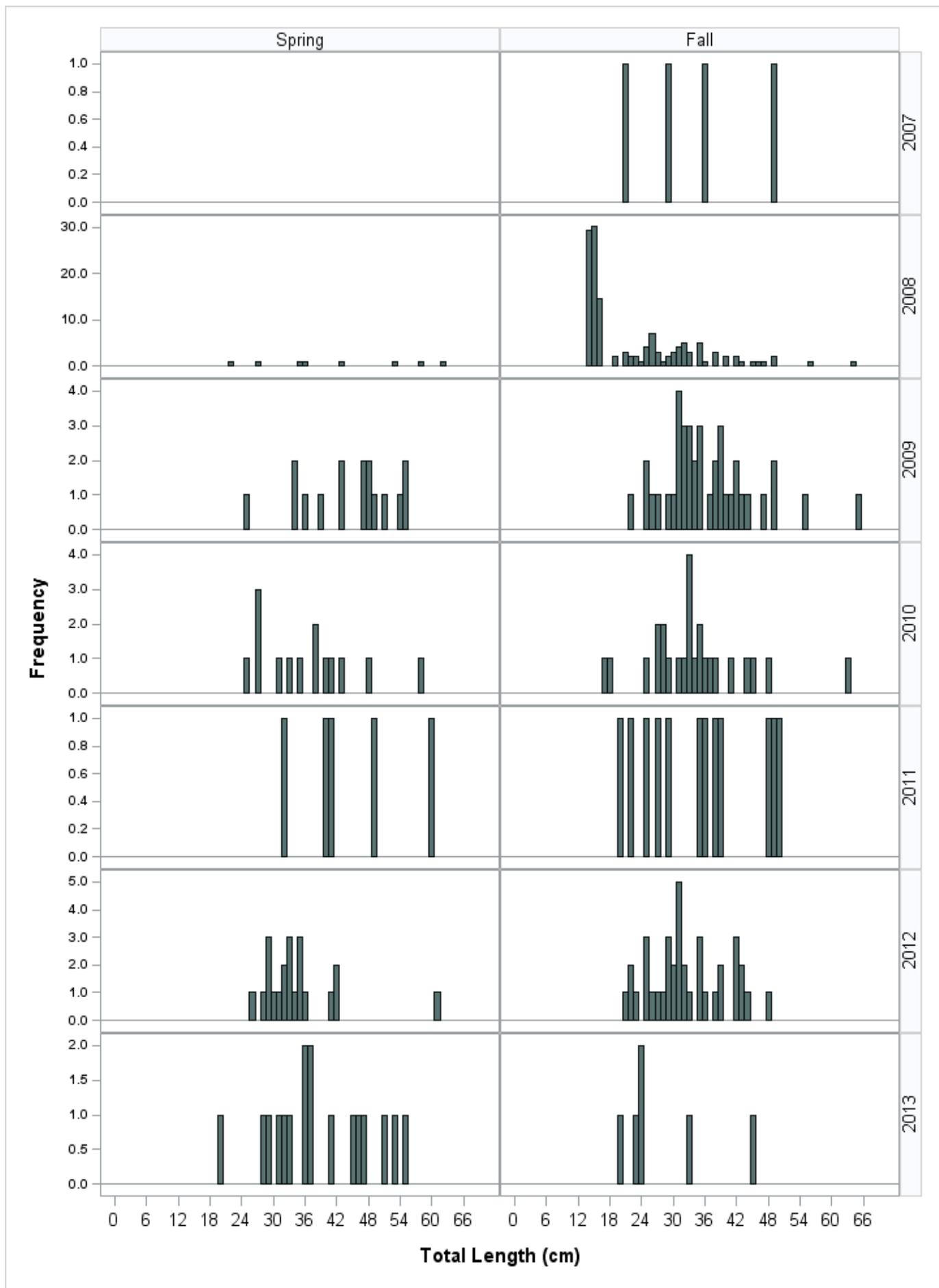


Figure 202. Tautog length-frequency distributions, by cruise and sex.

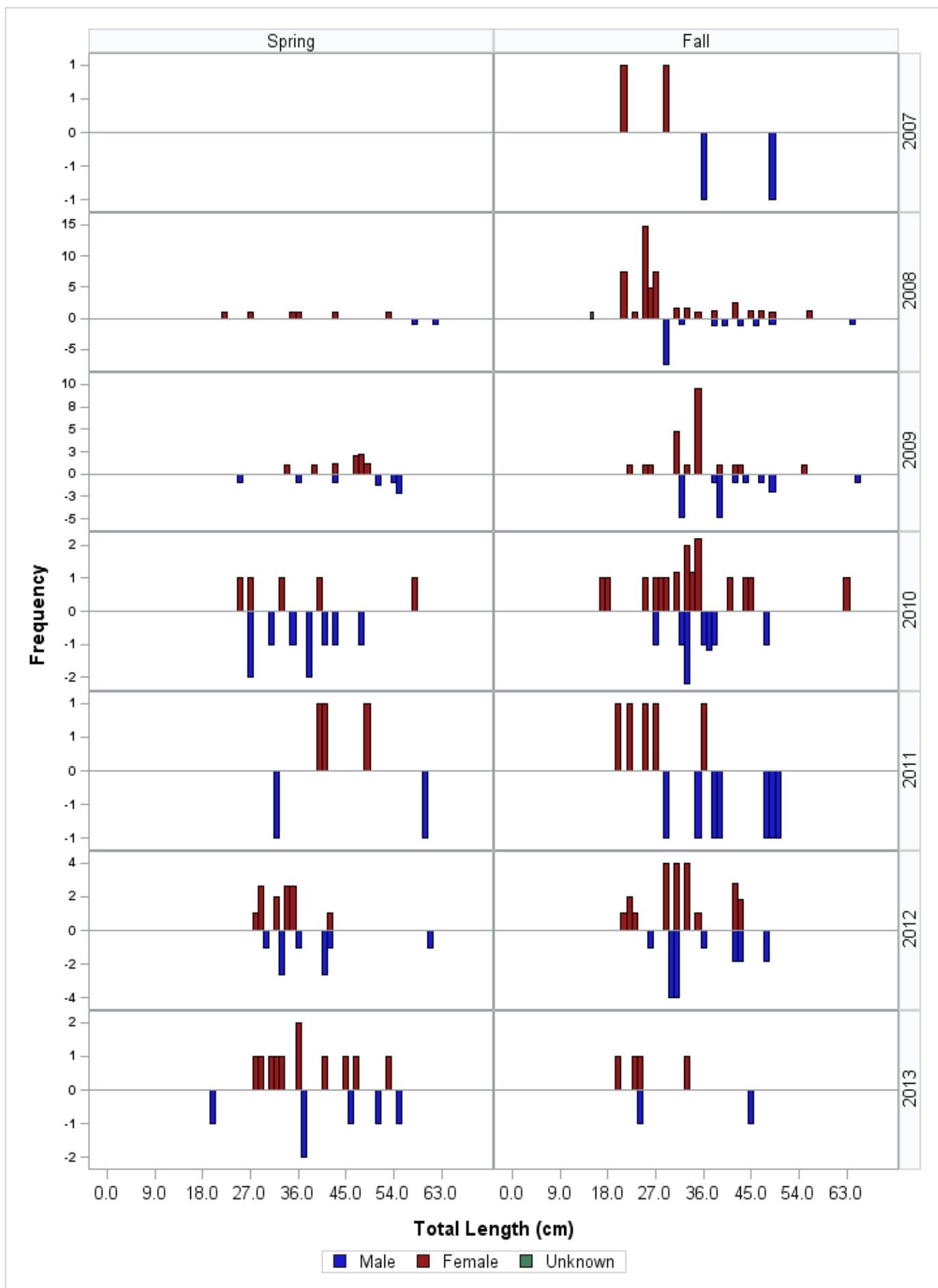
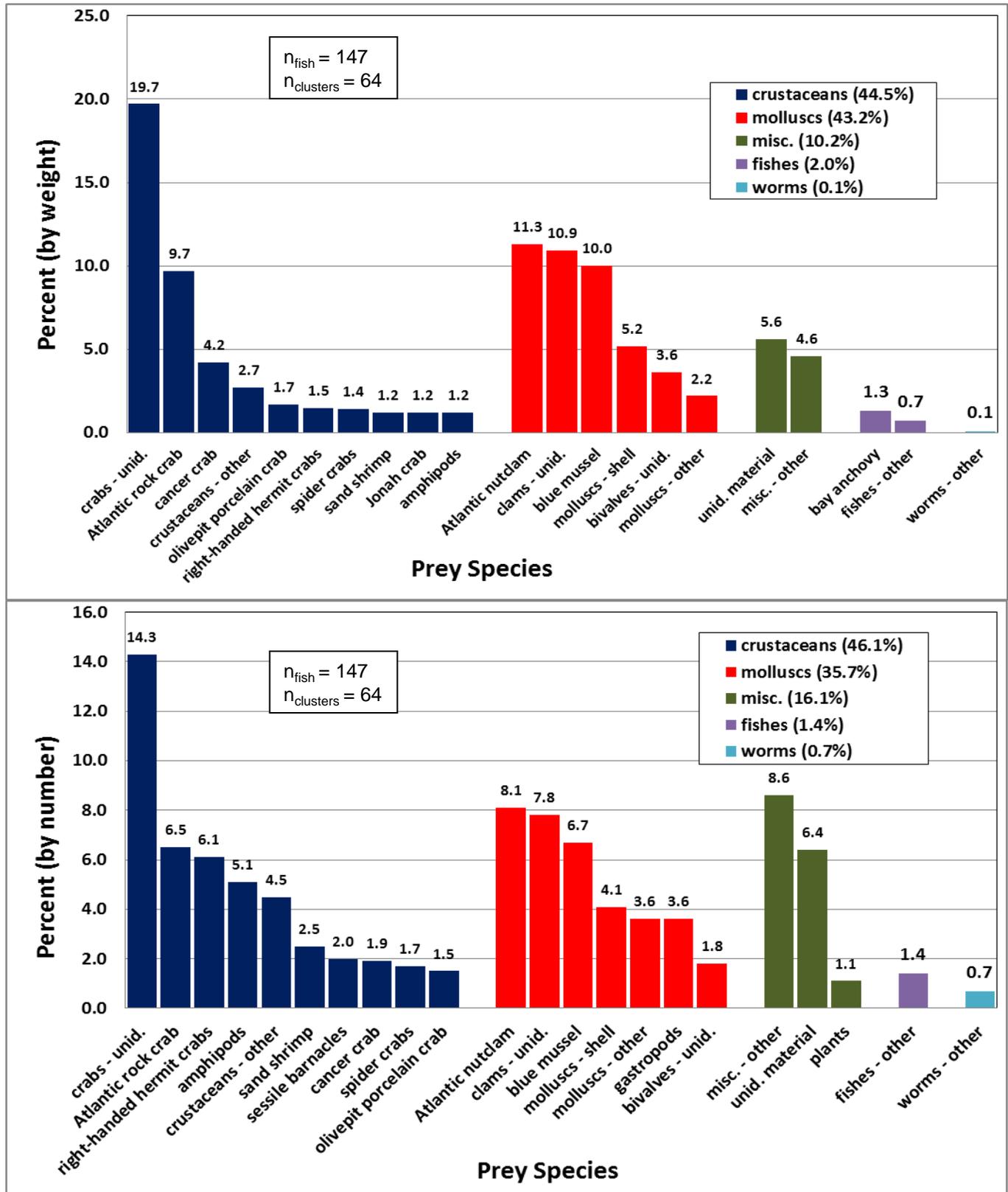


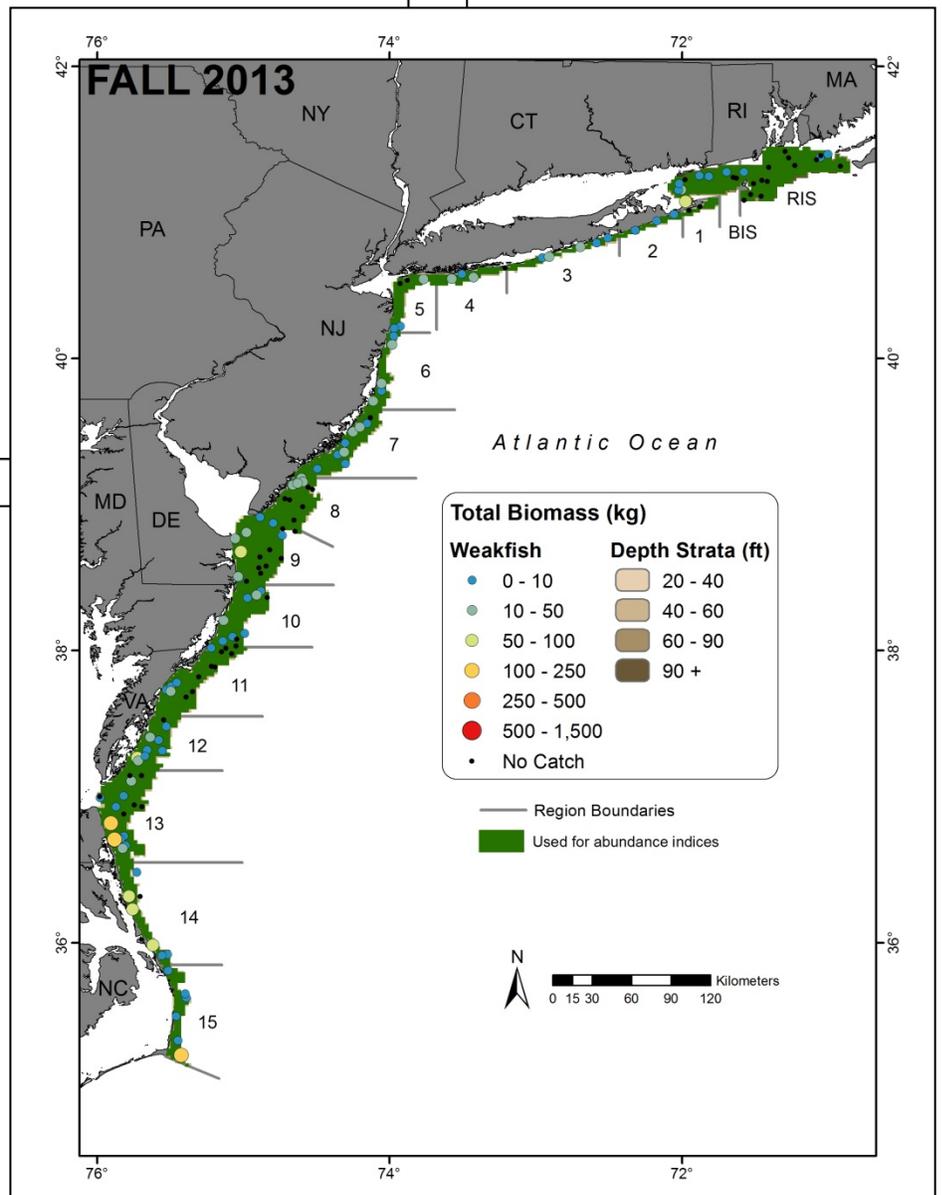
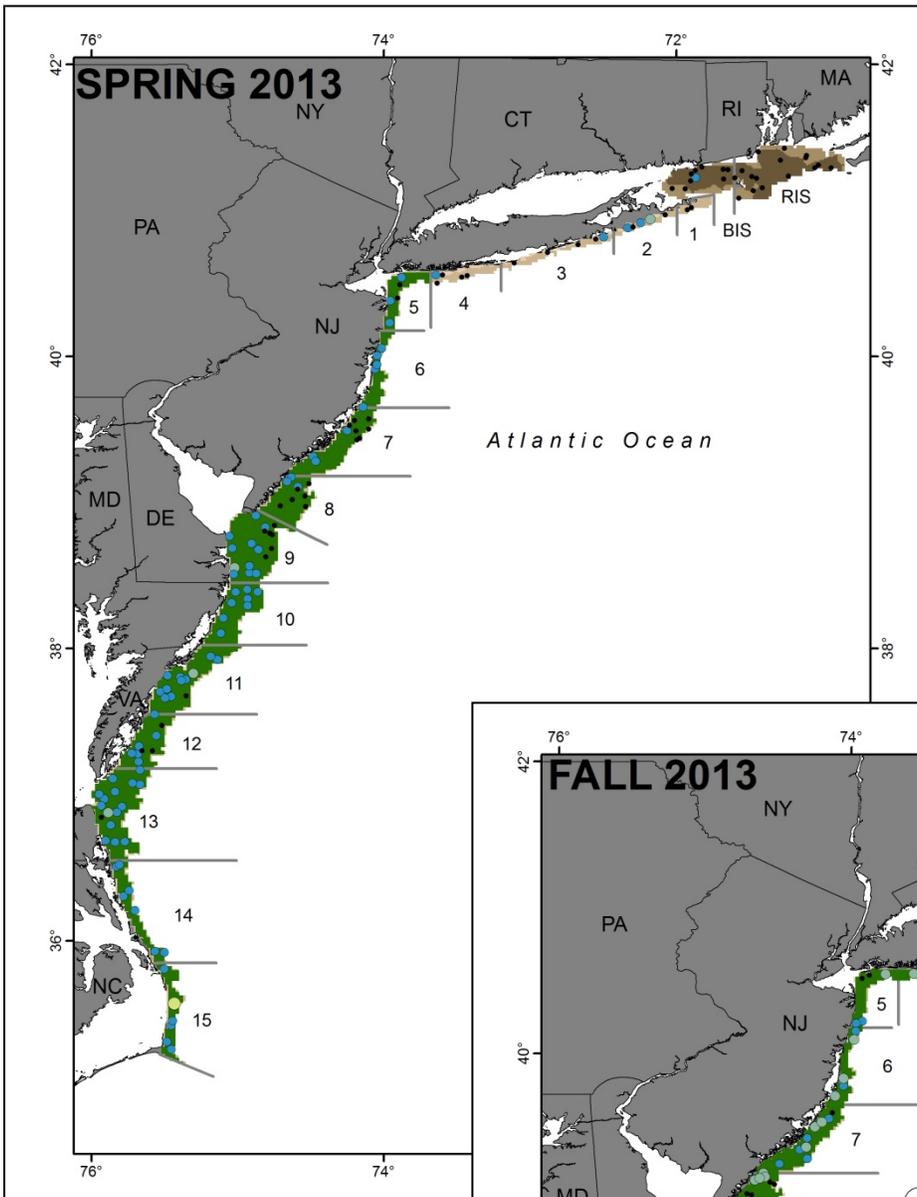
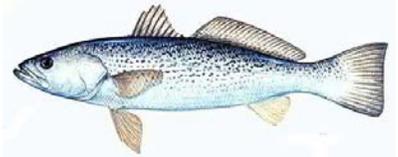
Figure 203. Tautog diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Weakfish

Sampling Priority: A

Figure 204. Weakfish biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
		20-40		
	02	40-60		
		20-40		
	03	40-60		
NJ	04	20-40		
		40-60		
	05	20-40		
DE	06	40-60		
		20-40		
	07	40-60		
		20-40		
MD	08	40-60		
		20-40		
	09	40-60		
VA	10	20-40		
		40-60		
	11	20-40		
NC	12	20-40		
		40-60		
	13	20-40		
NC	14	20-40		
		40-60		
	15	20-40		

Total Biomass (kg)

Weakfish	Depth Strata (ft)
● 0 - 10	■ 20 - 40
● 10 - 50	■ 40 - 60
● 50 - 100	■ 60 - 90
● 100 - 250	■ 90 +
● 250 - 500	
● 500 - 1,500	
● No Catch	

— Region Boundaries
 ■ Used for abundance indices

N
 0 15 30 60 90 120 Kilometers

Table 70. Weakfish sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	39,580	2,198.8	2,174	305	305	279	277
	2009	8,785	339.3	1,654	189	189	143	136
	2010	18,192	864.9	1,717	259	259	184	164
	2011	28,701	1,476.6	2,633	227	227	110	107
	2012	21,602	1,047.0	4,054	326	326	206	200
	2013	3,404	269.9	2,019	386	386	274	268
Fall	2007	60,990	4,168.1	5,747	572	572	472	468
	2008	44,779	3,990.4	3,879	464	464	333	320
	2009	96,394	5,556.9	13,012	872	872	648	628
	2010	80,684	5,795.7	8,115	611	611	464	455
	2011	115,593	7,556.9	10,061	796	796	638	611
	2012	58,568	4,624.2	11,478	793	793	586	554
	2013	24,265	1,596.8	8,982	607	607	390	0

Table 71. Weakfish geometric mean indices of abundance, for all specimens captured and by age-class for spring and fall NEAMAP surveys.

Spring Survey							Fall Survey										
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	150	7.31	11.15	16.78	2.13	3.02	4.15
	2008	106	4.85	6.64	8.96	1.02	1.41	1.88	2008	150	6.33	9.58	14.27	1.96	2.80	3.88	
	2009	113	1.19	1.80	2.58	0.25	0.39	0.55	2009	160	18.37	26.92	39.23	4.10	5.62	7.59	
	2010	107	1.97	3.07	4.58	0.34	0.63	0.99	2010	150	6.63	10.39	16.00	1.96	2.89	4.12	
	2011	107	1.77	2.85	4.35	0.39	0.73	1.16	2011	150	15.00	22.71	34.14	3.77	5.25	7.20	
	2012	107	6.00	8.76	12.62	1.06	1.57	2.21	2012	150	12.71	19.18	28.69	2.89	3.98	5.38	
	2013	107	4.09	5.51	7.33	0.66	0.93	1.24	2013	150	5.69	8.64	12.89	1.48	2.10	2.87	
	2014								2014								
	2015								2015								
	2016								2016								
0	2007								0	2007	150	4.28	6.37	9.28	1.19	1.67	2.25
	2008	106	0.00	0.00	0.00	0.00	0.00	0.00	2008	150	3.84	5.67	8.20	1.12	1.58	2.15	
	2009	113	0.00	0.00	0.00	0.00	0.00	0.00	2009	160	12.46	18.06	25.99	2.59	3.47	4.58	
	2010	107	0.00	0.00	0.00	0.00	0.00	0.00	2010	150	4.56	7.15	10.92	1.29	1.91	2.70	
	2011	107	0.00	0.00	0.00	0.00	0.00	0.00	2011	150	8.80	13.36	20.03	2.16	3.04	4.17	
	2012	107	0.00	0.00	0.00	0.00	0.00	0.00	2012	150	7.77	11.63	17.18	1.68	2.31	3.09	
	2013	107	0.00	0.00	0.00	0.00	0.00	0.00	2013	150	3.48	5.45	8.30	0.84	1.25	1.75	
	2014								2014								
	2015								2015								
	2016								2016								
1	2007								1	2007	150	3.45	5.08	7.31	1.05	1.48	1.99
	2008	106	3.95	5.41	7.31	0.85	1.20	1.61	2008	150	4.36	6.48	9.44	1.39	1.98	2.72	
	2009	113	0.92	1.43	2.07	0.19	0.32	0.46	2009	160	4.64	6.90	10.06	1.54	2.20	3.03	
	2010	107	1.75	2.77	4.15	0.29	0.57	0.91	2010	150	3.18	4.89	7.28	1.15	1.70	2.39	
	2011	107	1.41	2.32	3.59	0.31	0.62	1.01	2011	150	8.01	11.57	16.52	2.16	2.95	3.93	
	2012	107	4.62	6.89	10.08	0.86	1.32	1.88	2012	150	6.20	8.87	12.54	1.54	2.09	2.76	
	2013	107	1.96	2.69	3.62	0.30	0.47	0.66	2013	150	2.12	3.02	4.18	0.59	0.82	1.09	
	2014								2014								
	2015								2015								
	2016								2016								
2+	2007								2+	2007	150	2.17	3.15	4.44	0.77	1.09	1.47
	2008	106	1.79	2.43	3.22	0.37	0.54	0.73	2008	150	0.70	1.07	1.52	0.19	0.34	0.50	
	2009	113	0.46	0.72	1.03	0.07	0.13	0.20	2009	160	1.51	2.14	2.92	0.46	0.65	0.86	
	2010	107	0.43	0.74	1.11	0.05	0.17	0.31	2010	150	0.44	0.65	0.90	0.14	0.22	0.31	
	2011	107	0.75	1.23	1.84	0.17	0.33	0.52	2011	150	3.42	4.70	6.34	0.95	1.27	1.65	
	2012	107	1.70	2.49	3.52	0.29	0.48	0.69	2012	150	2.36	3.27	4.42	0.72	0.97	1.25	
	2013	107	2.65	3.55	4.69	0.44	0.62	0.82	2013	150	1.63	2.27	3.07	0.49	0.68	0.89	
	2014								2014								
	2015								2015								
	2016								2016								

Figure 205. Weakfish geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.

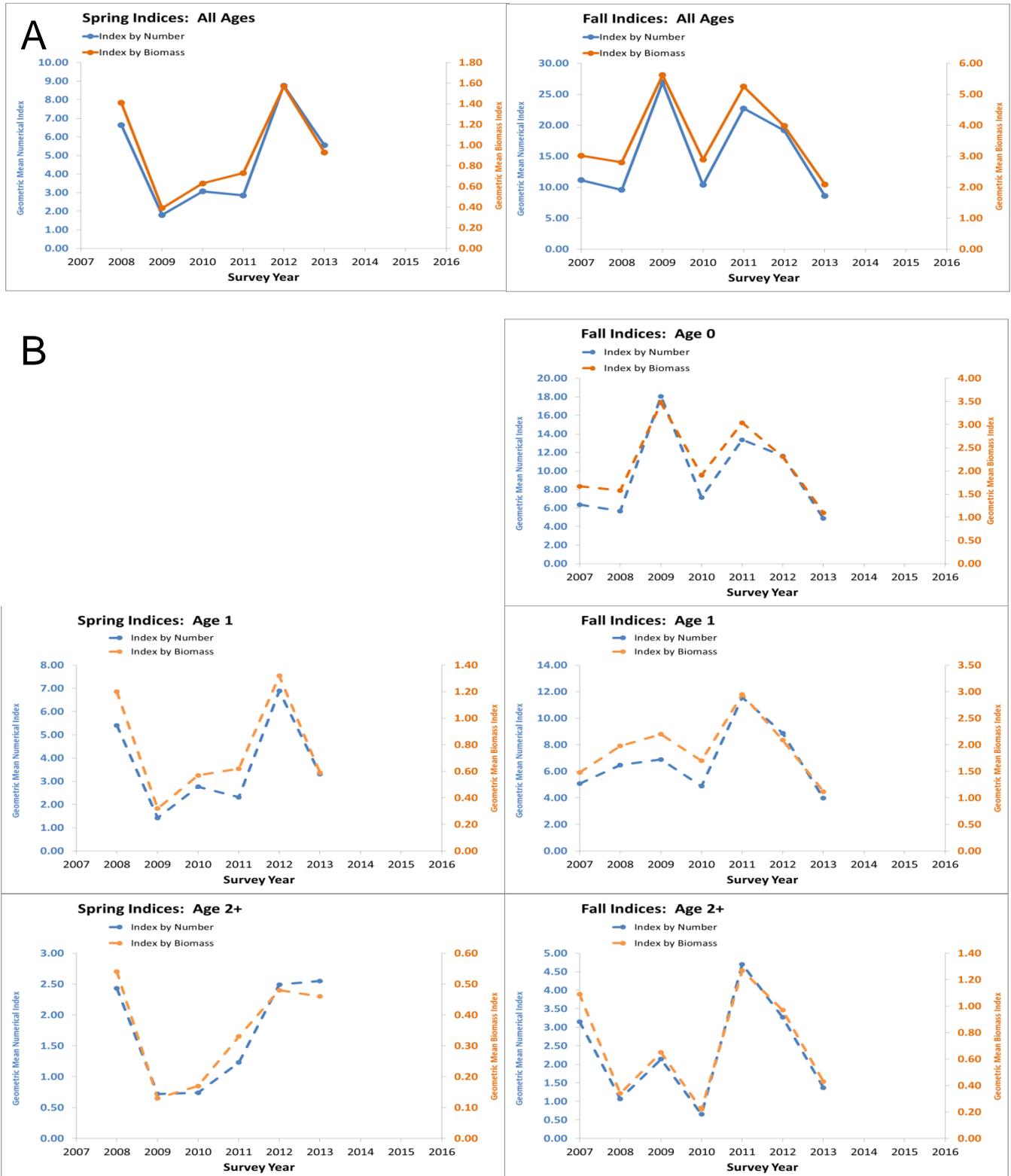


Figure 206. Weakfish length-frequency distributions, by cruise.

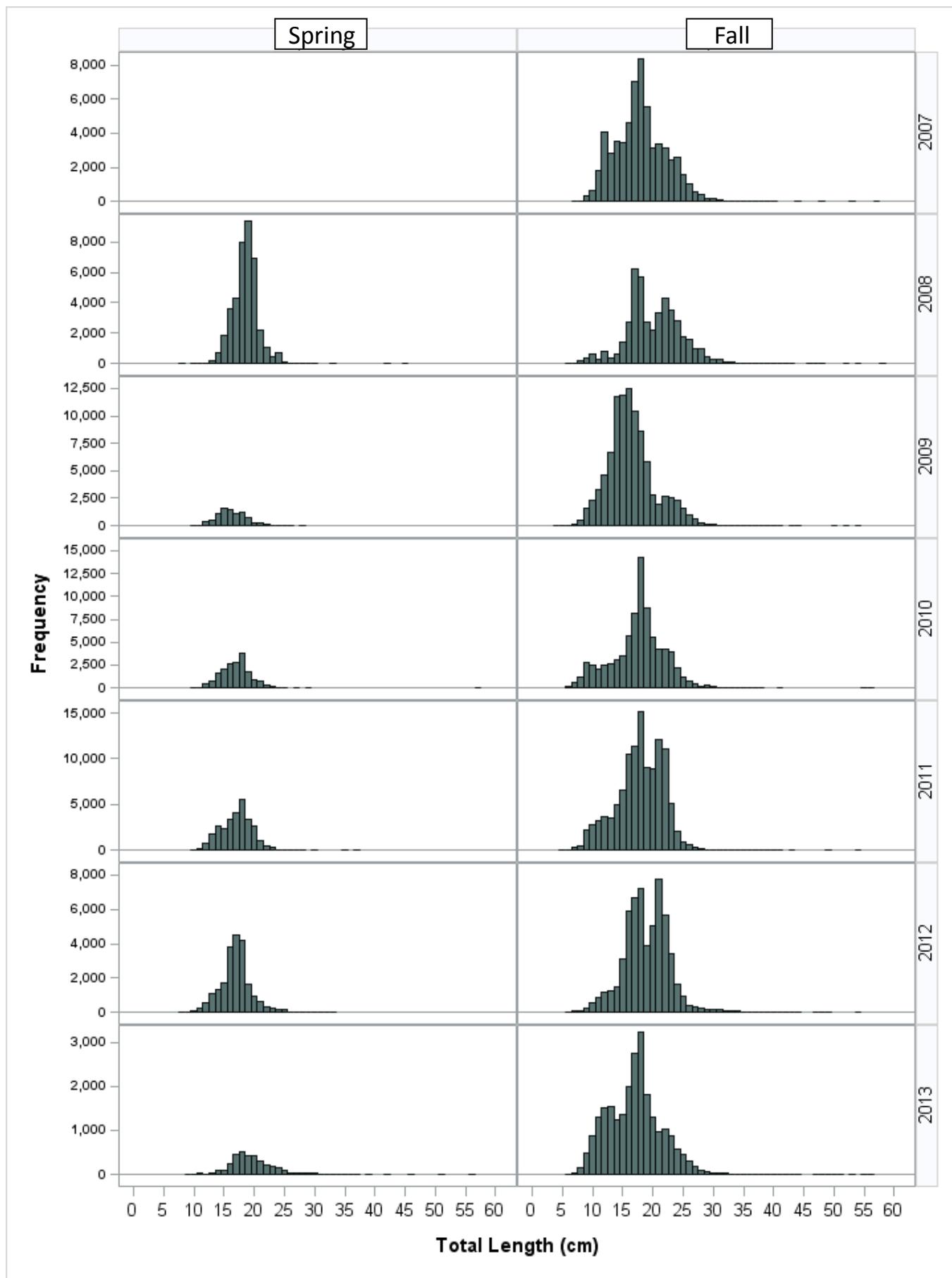


Figure 207. Weakfish length-frequency distributions, by cruise and sex.

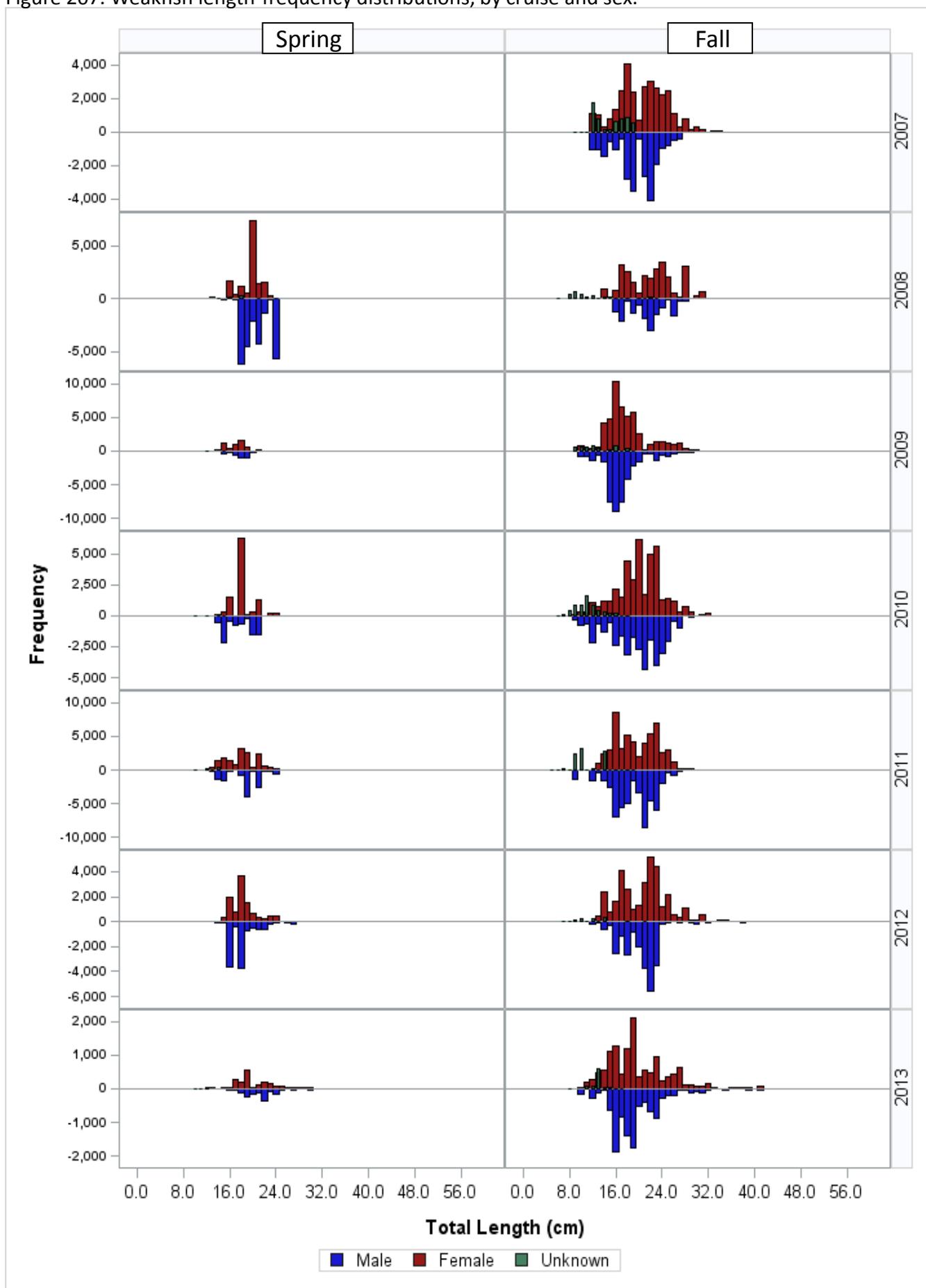


Figure 208. Weakfish age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar.

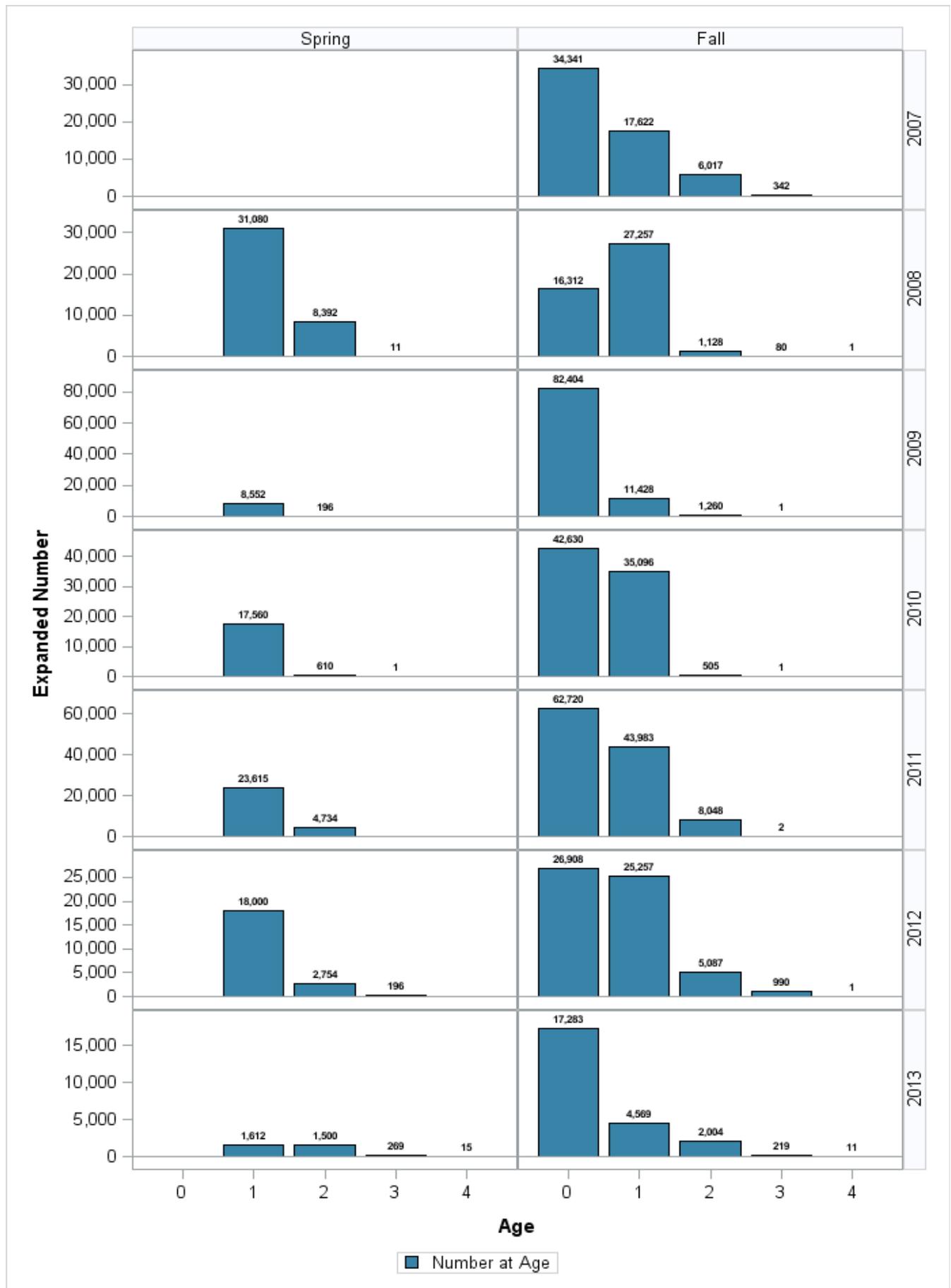


Figure 209. Weakfish catch-at-age standardized to 3,000 trawl minutes, by cruise.

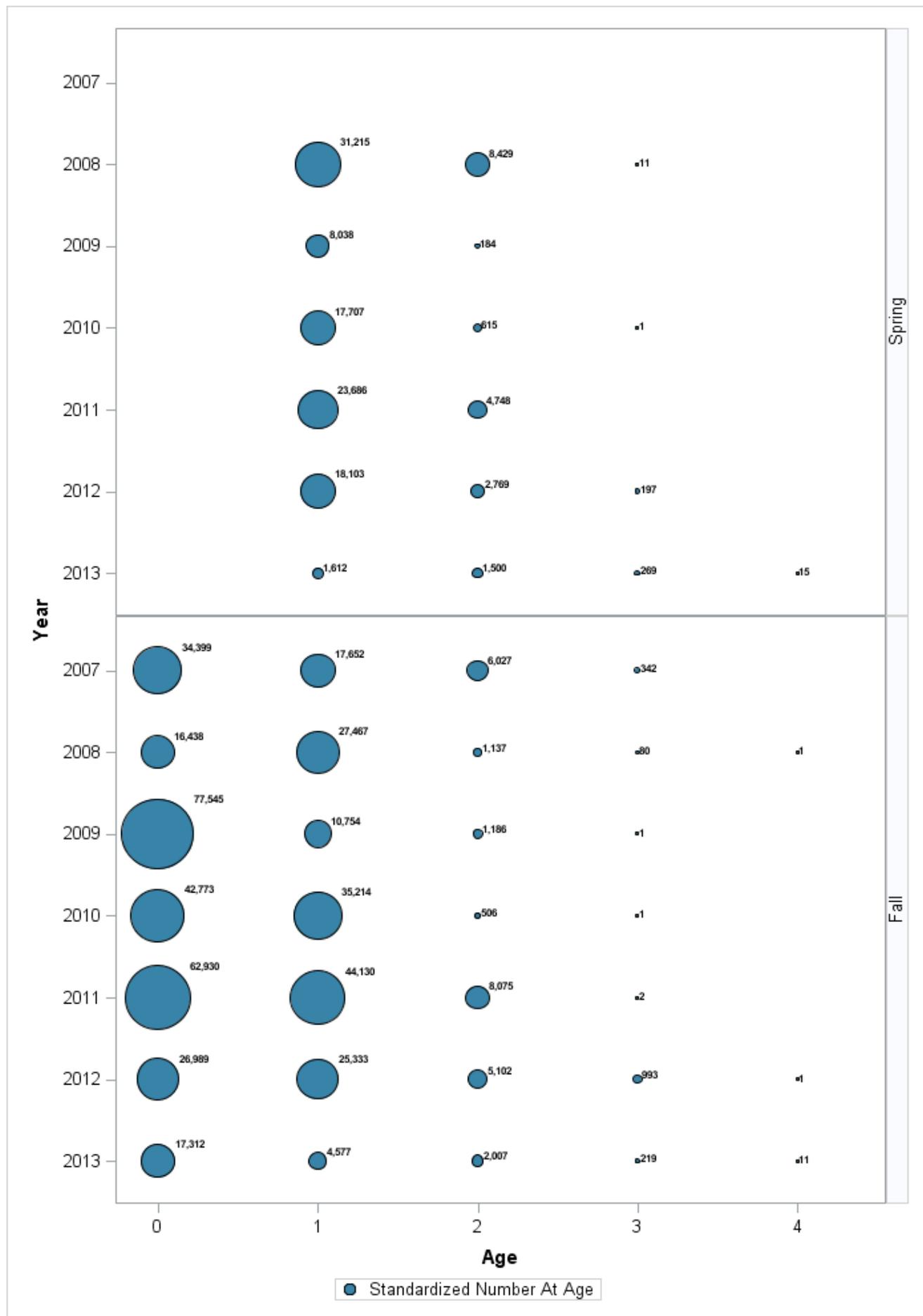


Figure 210. Weakfish sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

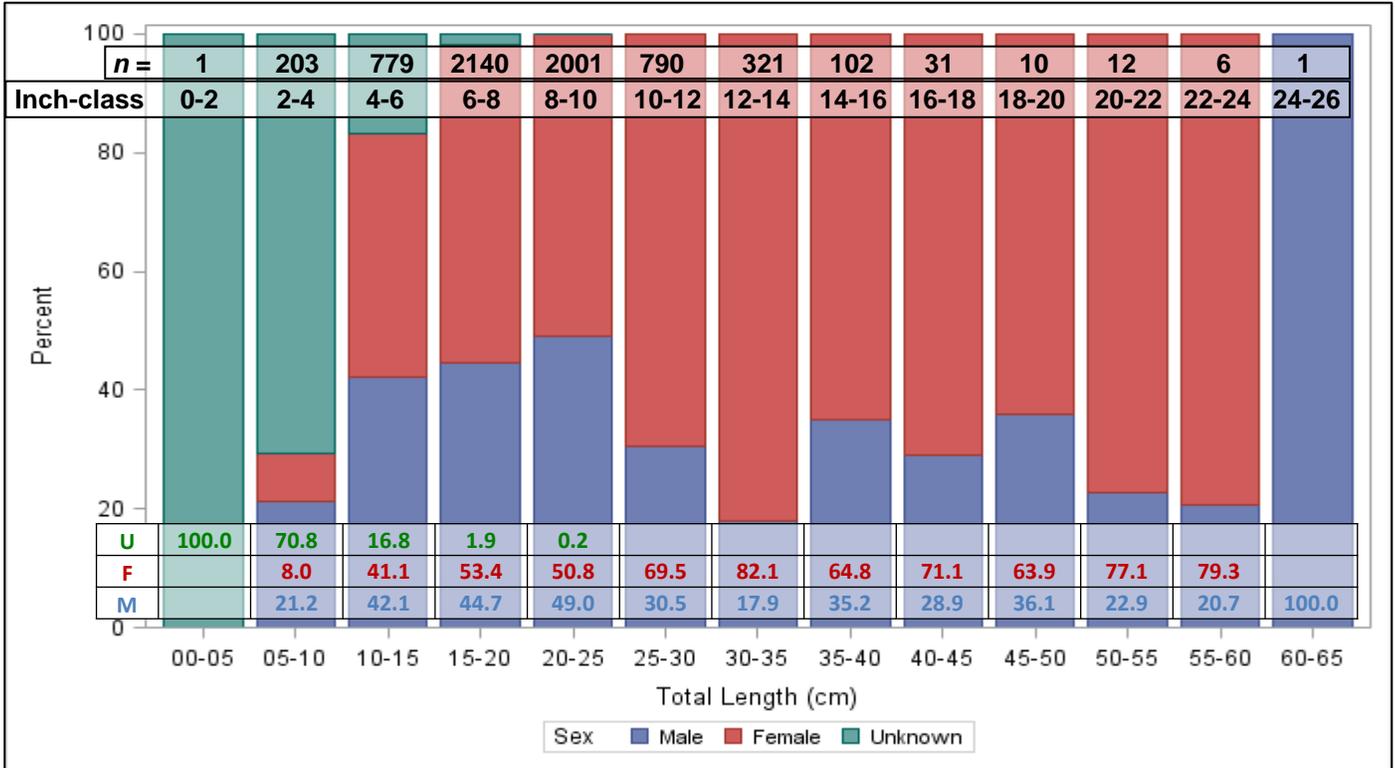


Figure 211. Weakfish maturity at length, by sex for all cruises pooled, 2007-2013.

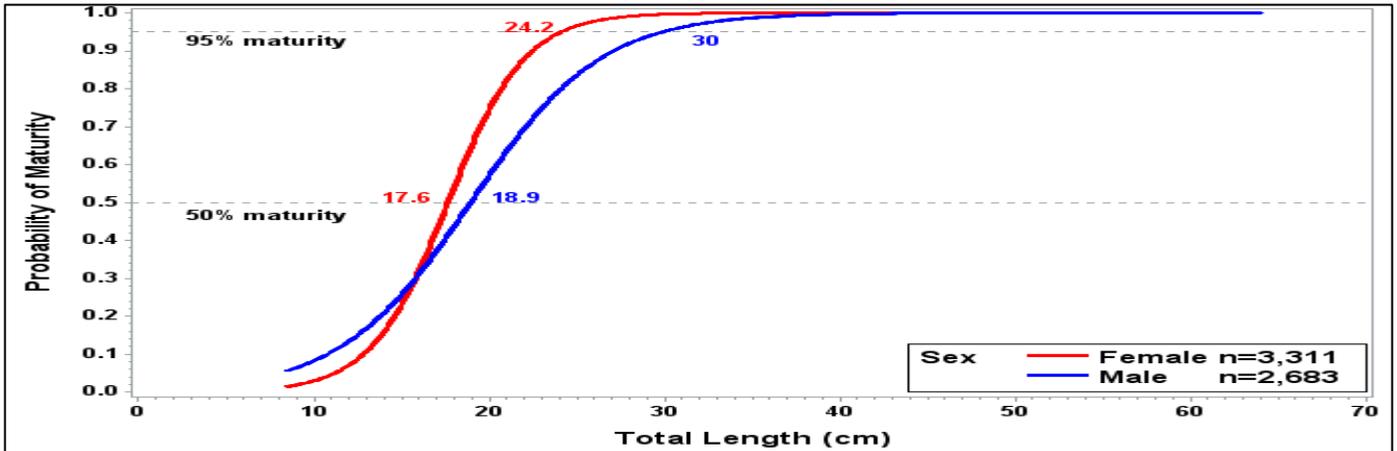


Figure 212. Weakfish maturity at age, by sex for all cruises pooled, 2007-2013.

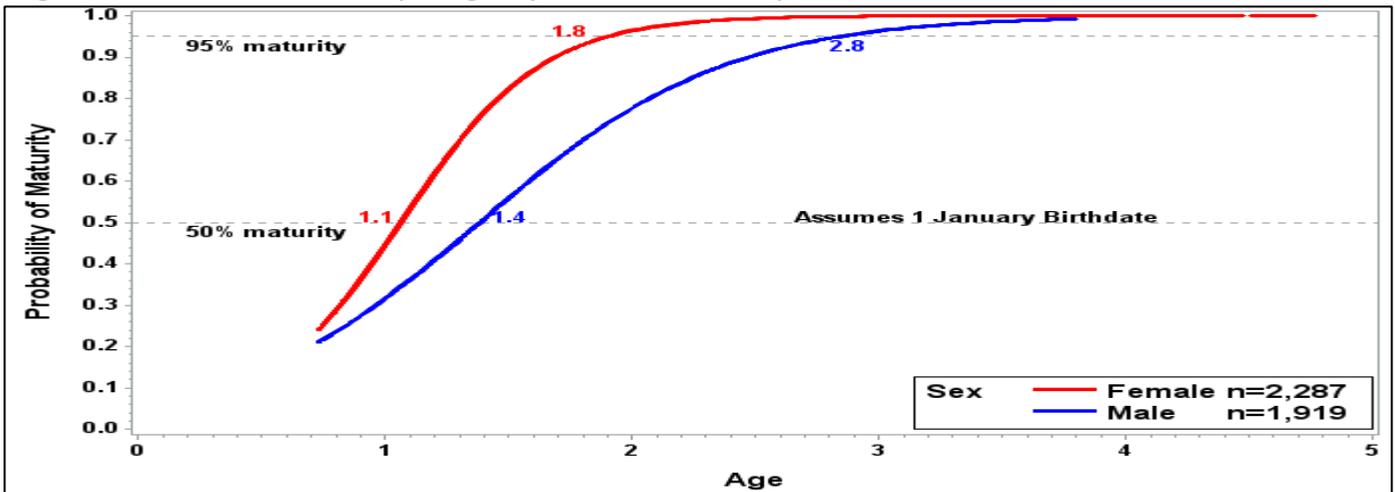
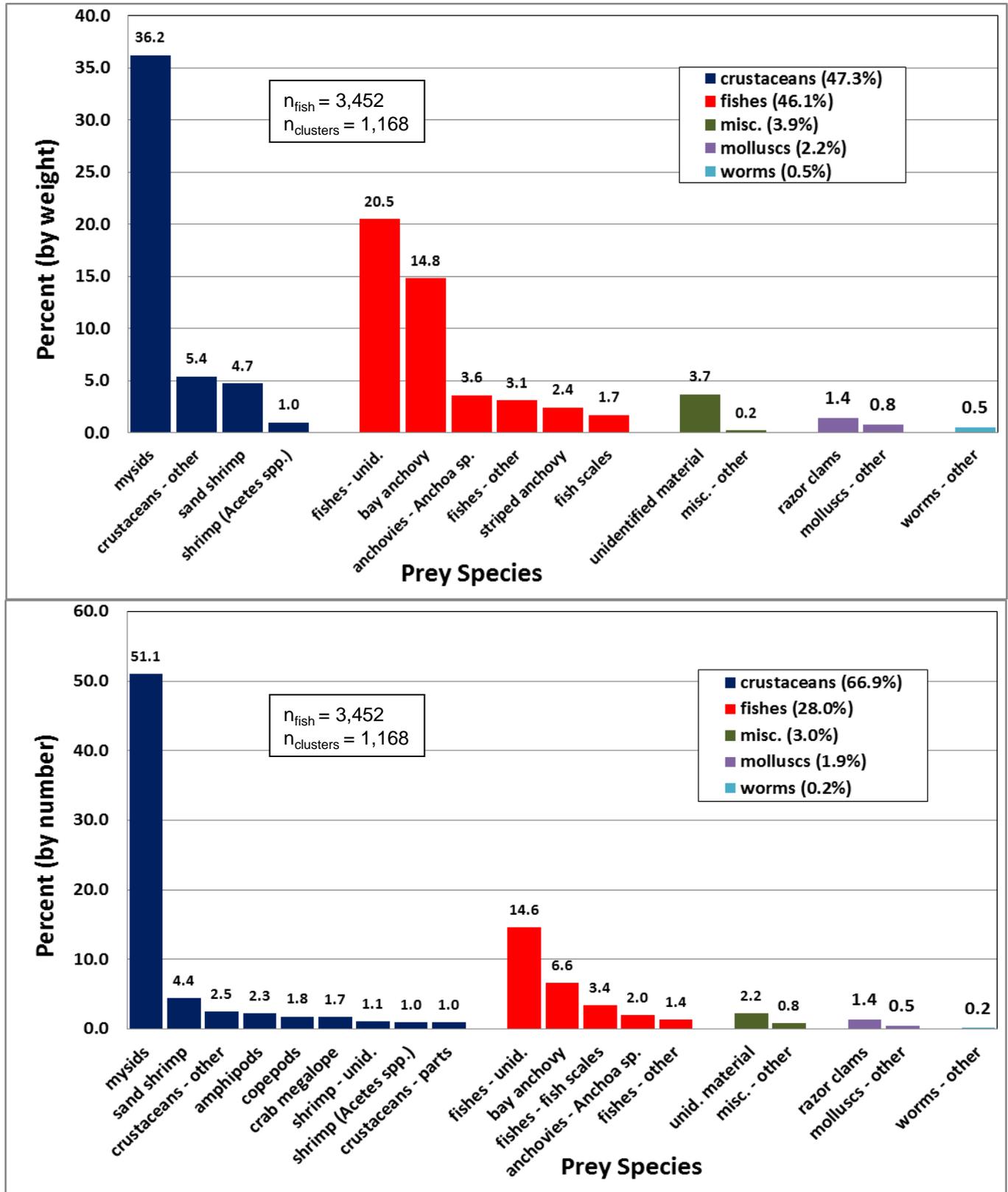


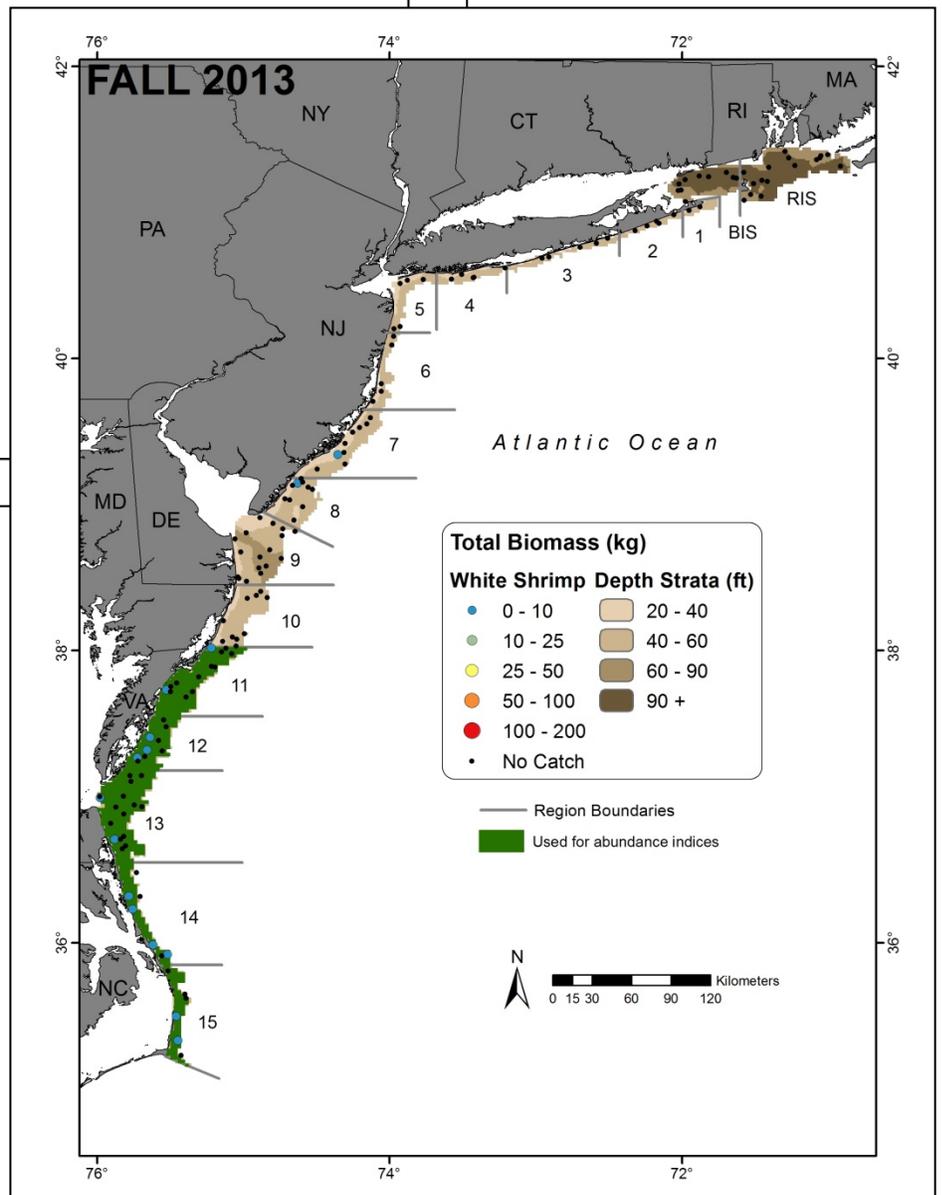
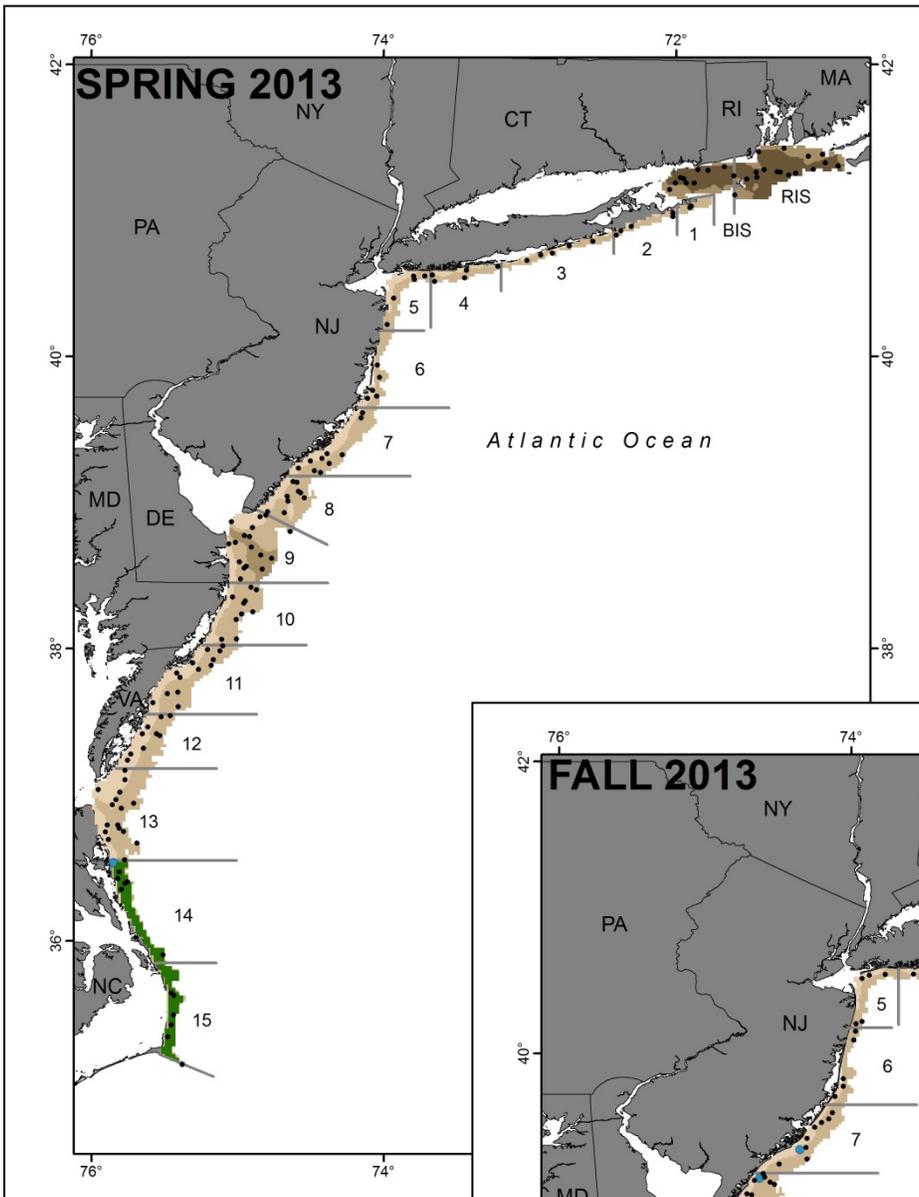
Figure 213. Weakfish diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



White Shrimp

Sampling Priority: E

Figure 214. White Shrimp biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	60-90		
NY	01	90+		
		40-60		
		20-40		
		40-60		
		40-60		
NJ	06	20-40		
		40-60		
		20-40		
		40-60		
		40-60		
DE	09	20-40		
		40-60		
		60-90		
MD	10	20-40		
		40-60		
VA	11	20-40		
		40-60		
		20-40		
		40-60		
NC	14	20-40		
		40-60		
		20-40		
NC	15	20-40		
		40-60		

Total Biomass (kg)

White Shrimp Depth Strata (ft)

- 0 - 10
- 10 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- No Catch
- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

— Region Boundaries
 ■ Used for abundance indices

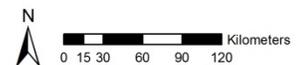


Table 72. White Shrimp sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	0	0.0	0	N/A	N/A	N/A	N/A
	2009	23	0.7	23	N/A	N/A	N/A	N/A
	2010	0	0.0	0	N/A	N/A	N/A	N/A
	2011	0	0.0	0	N/A	N/A	N/A	N/A
	2012	4	0.2	4	N/A	N/A	N/A	N/A
	2013	109	2.8	109	N/A	N/A	N/A	N/A
Fall	2007	48	1.8	20	N/A	N/A	N/A	N/A
	2008	753	19.7	267	N/A	N/A	N/A	N/A
	2009	451	6.6	451	N/A	N/A	N/A	N/A
	2010	3,312	87.2	521	N/A	N/A	N/A	N/A
	2011	16	0.5	16	N/A	N/A	N/A	N/A
	2012	839	18.0	839	N/A	N/A	N/A	N/A
	2013	974	22.5	534	N/A	N/A	N/A	N/A

Table 73. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey									Fall Survey								
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	56	0.06	0.17	0.29	0.00	0.02	0.03
	2008	13	0.00	0.00	0.00	0.00	0.00	0.00		2008	51	0.37	0.98	1.86	0.04	0.15	0.28
	2009	15	0.00	0.23	0.58	0.00	0.02	0.06		2009	53	0.44	0.95	1.64	0.02	0.07	0.13
	2010	13	0.00	0.00	0.00	0.00	0.00	0.00		2010	51	0.50	1.26	2.41	0.06	0.30	0.60
	2011	13	0.00	0.00	0.00	0.00	0.00	0.00		2011	51	0.00	0.09	0.20	0.00	0.01	0.02
	2012	13	0.00	0.07	0.21	0.00	0.01	0.02		2012	51	0.73	1.49	2.57	0.07	0.17	0.28
	2013	13	0.80	1.76	3.24	0.03	0.11	0.21		2013	51	0.22	0.69	1.33	0.01	0.13	0.27
	2014									2014							
	2015									2015							
	2016									2016							

Figure 215. White Shrimp geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

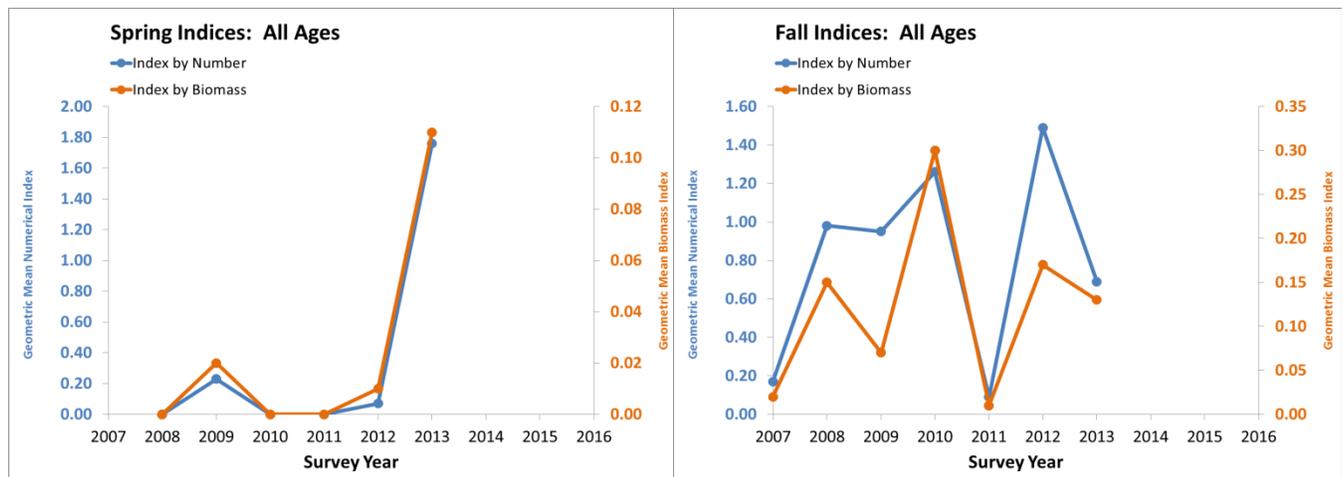
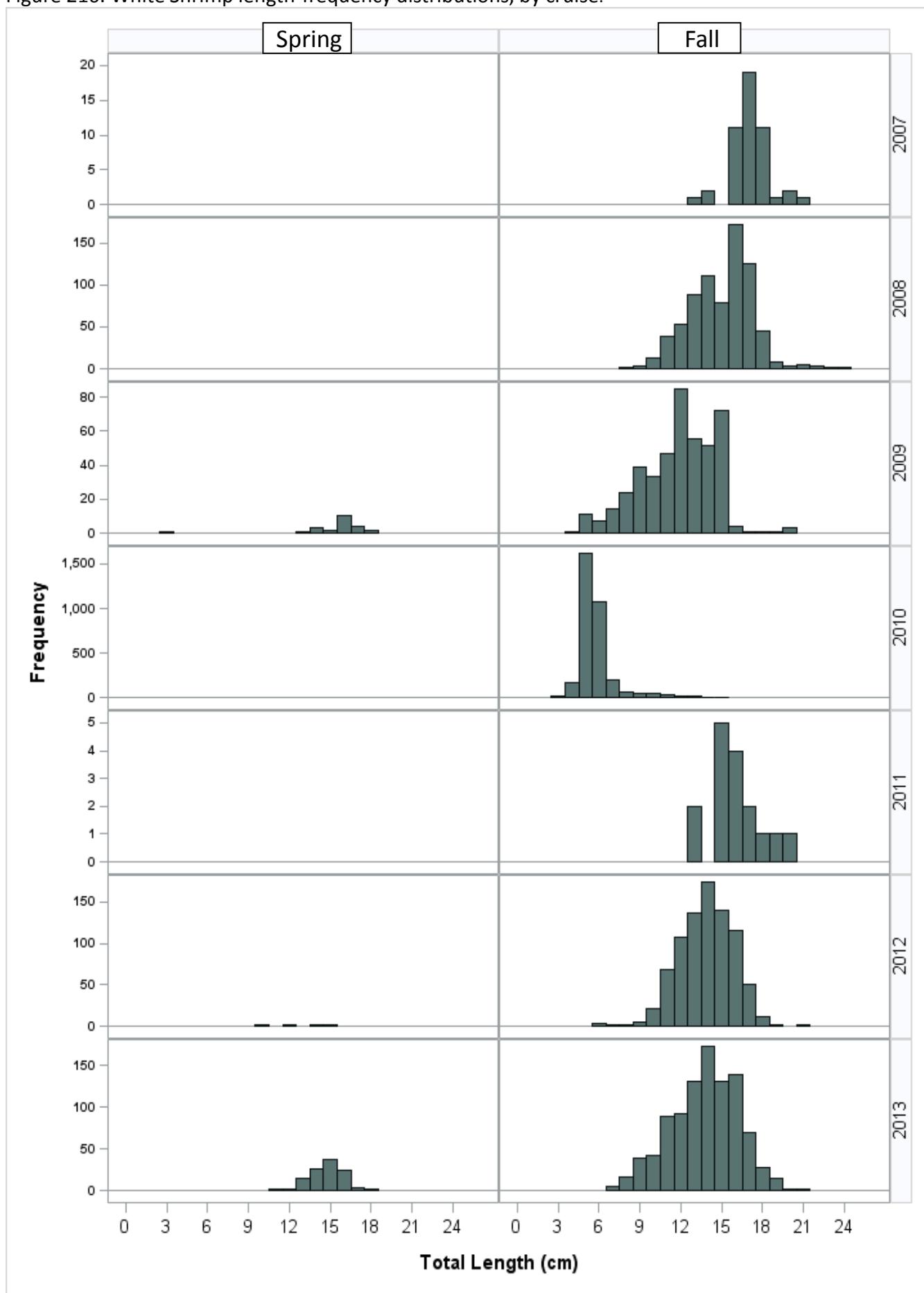


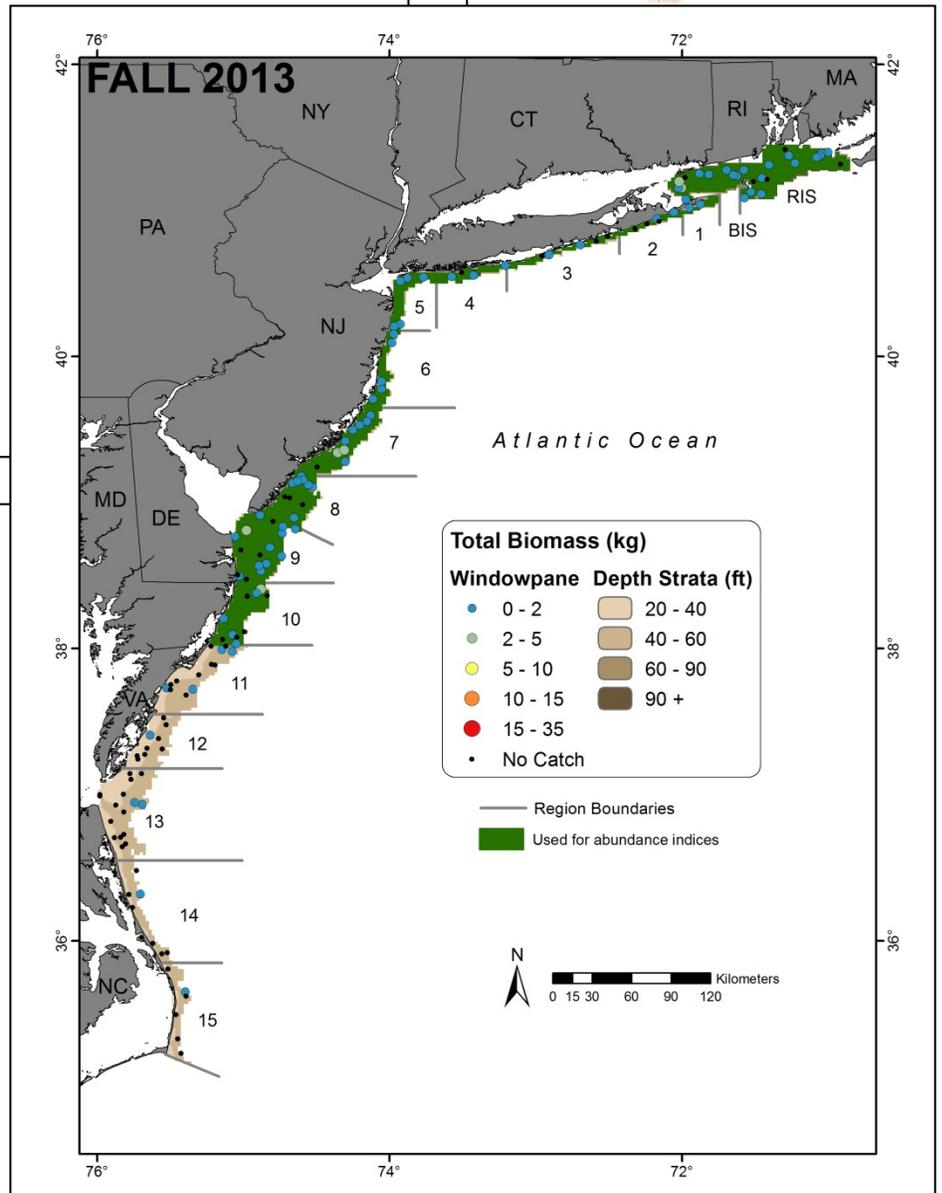
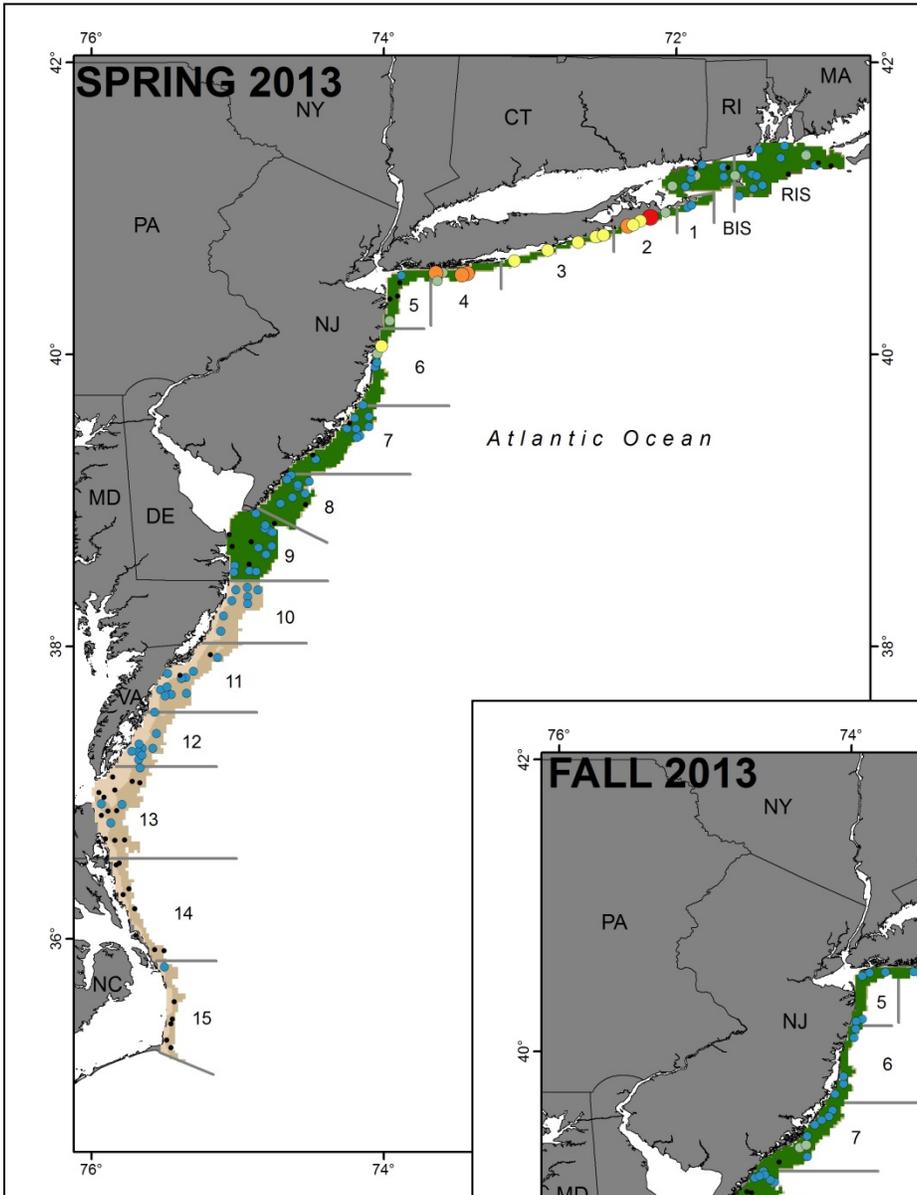
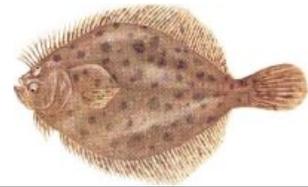
Figure 216. White Shrimp length-frequency distributions, by cruise.



Windowpane Flounder

Sampling Priority: A (As of 2012)

Figure 217. Windowpane Flounder biomass (kg) collected at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
		90+		
	BIS	60-90		
		90+		
NY	01	40-60		
	02	20-40		
		40-60		
	03	20-40		
	04	40-60		
NJ	05	20-40		
	06	40-60		
	07	20-40		
DE	08	40-60		
	09	20-40		
		60-90		
MD	10	20-40		
VA		40-60		
	11	20-40		
		40-60		
NC	12	20-40		
		40-60		
	13	20-40		
	14	20-40		
		40-60		
	15	20-40		
		40-60		

= used for abundance indices
 = not used for abundance indices

Table 74. Windowpane Flounder sampling rates for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	756	191.0	697	0	0	0	0
	2009	1,067	268.2	868	0	0	0	0
	2010	1,065	237.1	847	0	0	0	0
	2011	936	214.0	936	0	0	0	0
	2012	994	232.7	994	299	0	206	187
	2013	904	187.7	840	339	0	212	200
Fall	2007	744	114.0	694	0	0	0	0
	2008	475	79.4	410	0	0	0	0
	2009	1,133	198.2	1,133	0	0	0	0
	2010	1,208	172.9	1,033	0	0	0	0
	2011	1,202	189.3	1,202	0	0	0	0
	2012	856	137.7	856	354	0	237	220
	2013	416	63.4	416	244	0	154	0

Table 75. Windowpane flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey						Fall Survey														
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index					
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI			
All	2007								All	2007	94	3.25	4.16	5.26	0.64	0.80	0.97			
	2008	85	3.00	3.86	4.90	0.94	1.18	1.44		2008	99	1.28	1.70	2.18	0.30	0.40	0.51			
	2009	96	2.51	3.12	3.84	0.78	0.97	1.18		2009	107	3.67	4.77	6.12	0.86	1.09	1.36			
	2010	89	2.11	2.83	3.72	0.67	0.84	1.03		2010	99	4.24	5.52	7.13	0.84	1.06	1.31			
	2011	89	2.42	3.12	3.95	0.75	0.95	1.17		2011	99	4.47	5.76	7.36	0.96	1.21	1.48			
	2012	89	2.30	2.93	3.67	0.64	0.82	1.02		2012	99	2.95	3.86	4.97	0.61	0.80	1.01			
	2013	89	1.98	2.64	3.46	0.56	0.72	0.90		2013	99	1.74	2.31	2.99	0.39	0.51	0.63			
	2014									2014										
	2015									2015										
	2016									2016										

Figure 218. Windowpane Flounder geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

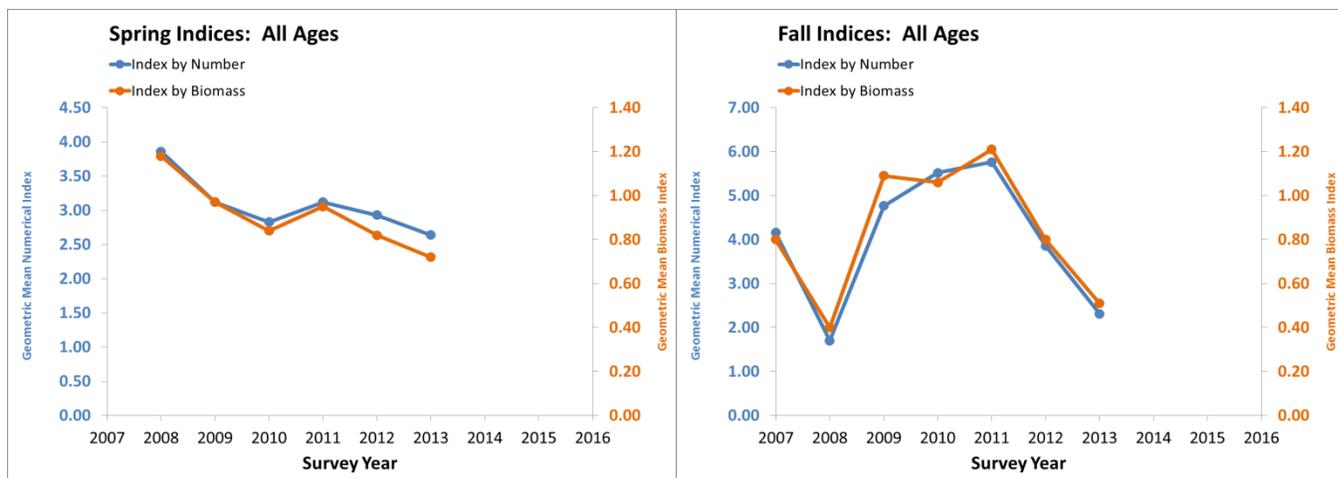


Figure 219. Windowpane Flounder length-frequency distributions, by cruise.

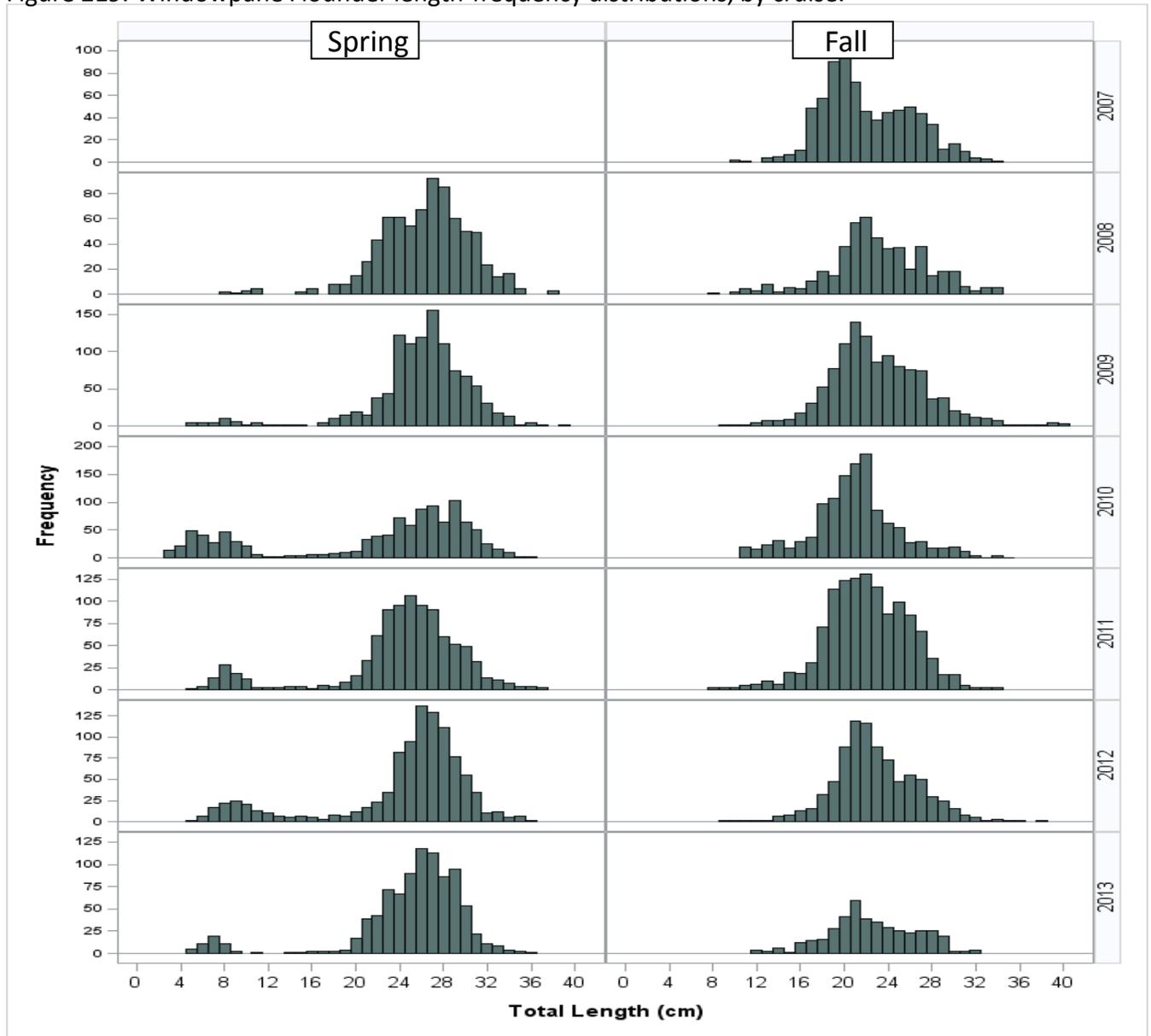


Figure 220. Windowpane Flounder length-frequency distributions, by cruise and sex.

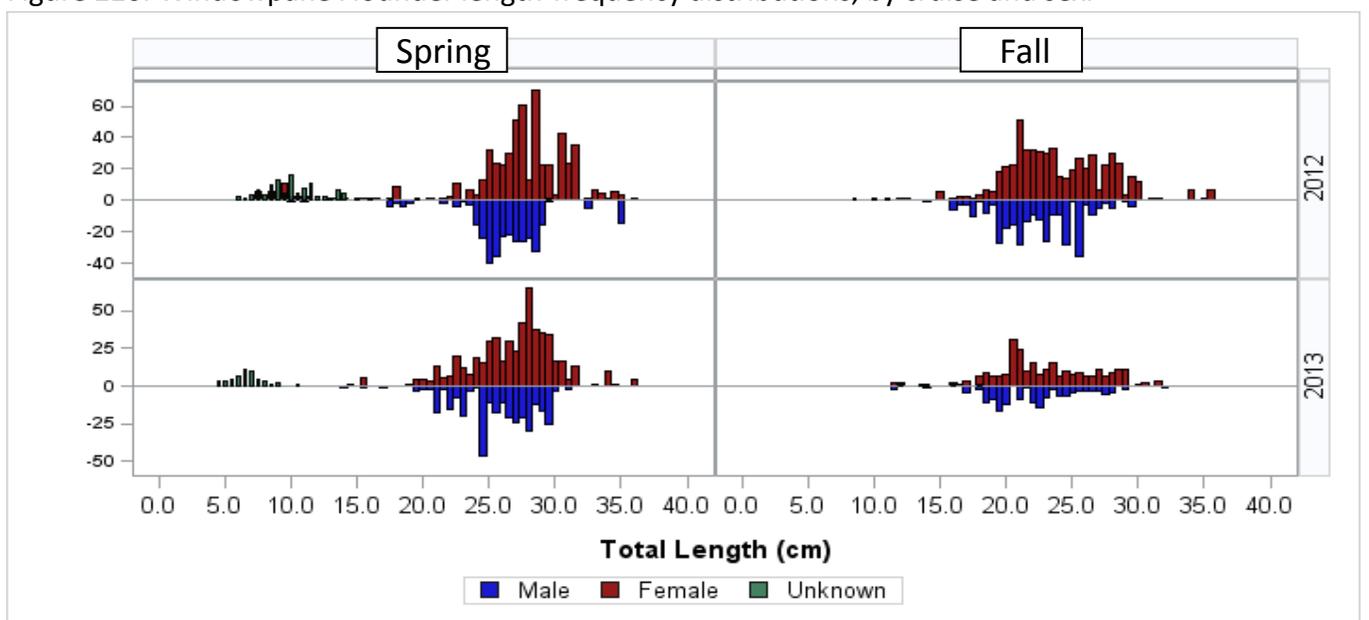


Figure 221. Windowpane Flounder sex ratio, by length group, for all cruises pooled, 2012-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

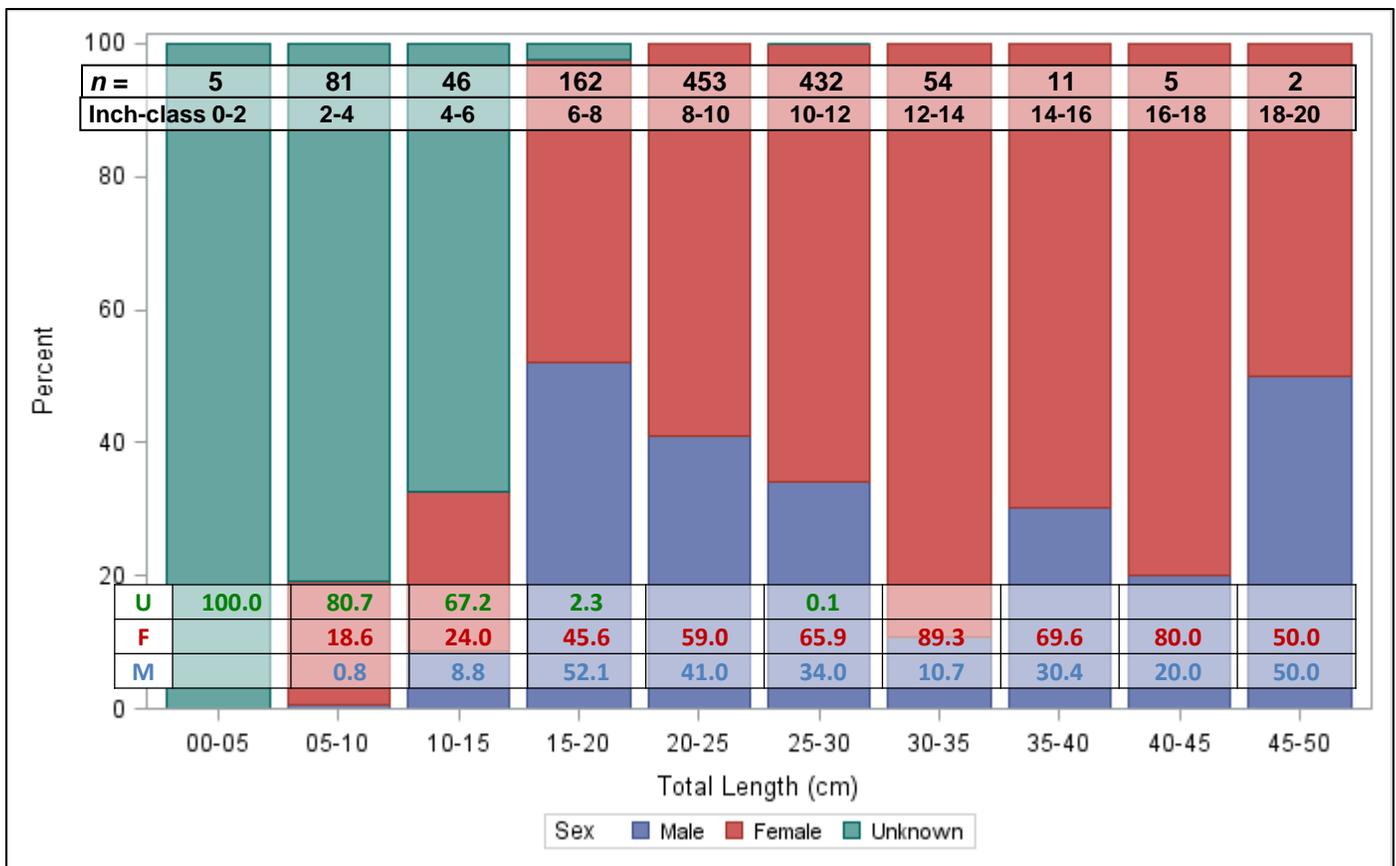


Figure 222. Windowpane Flounder maturity at length, by sex for all cruises pooled, 2012-2013.

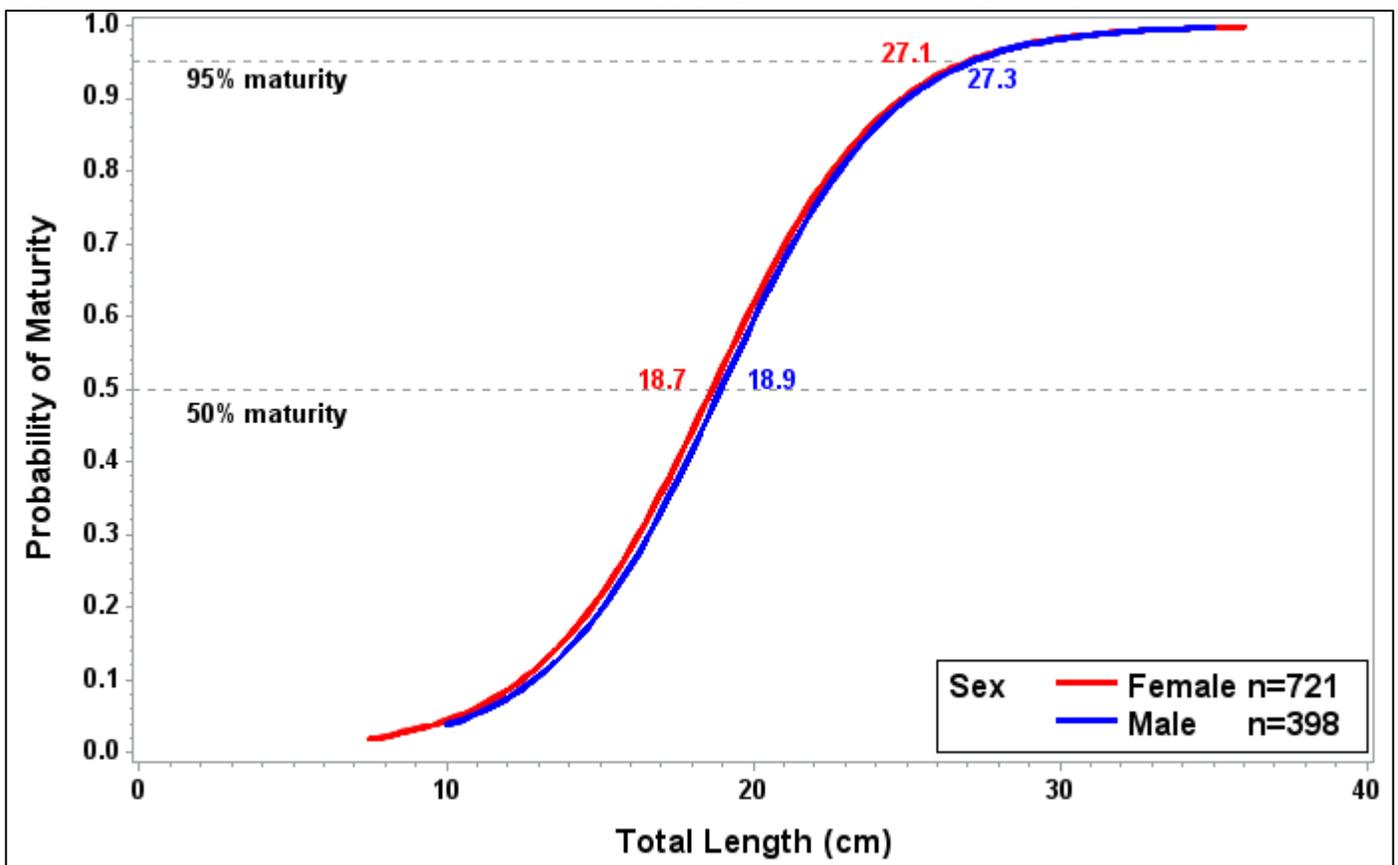
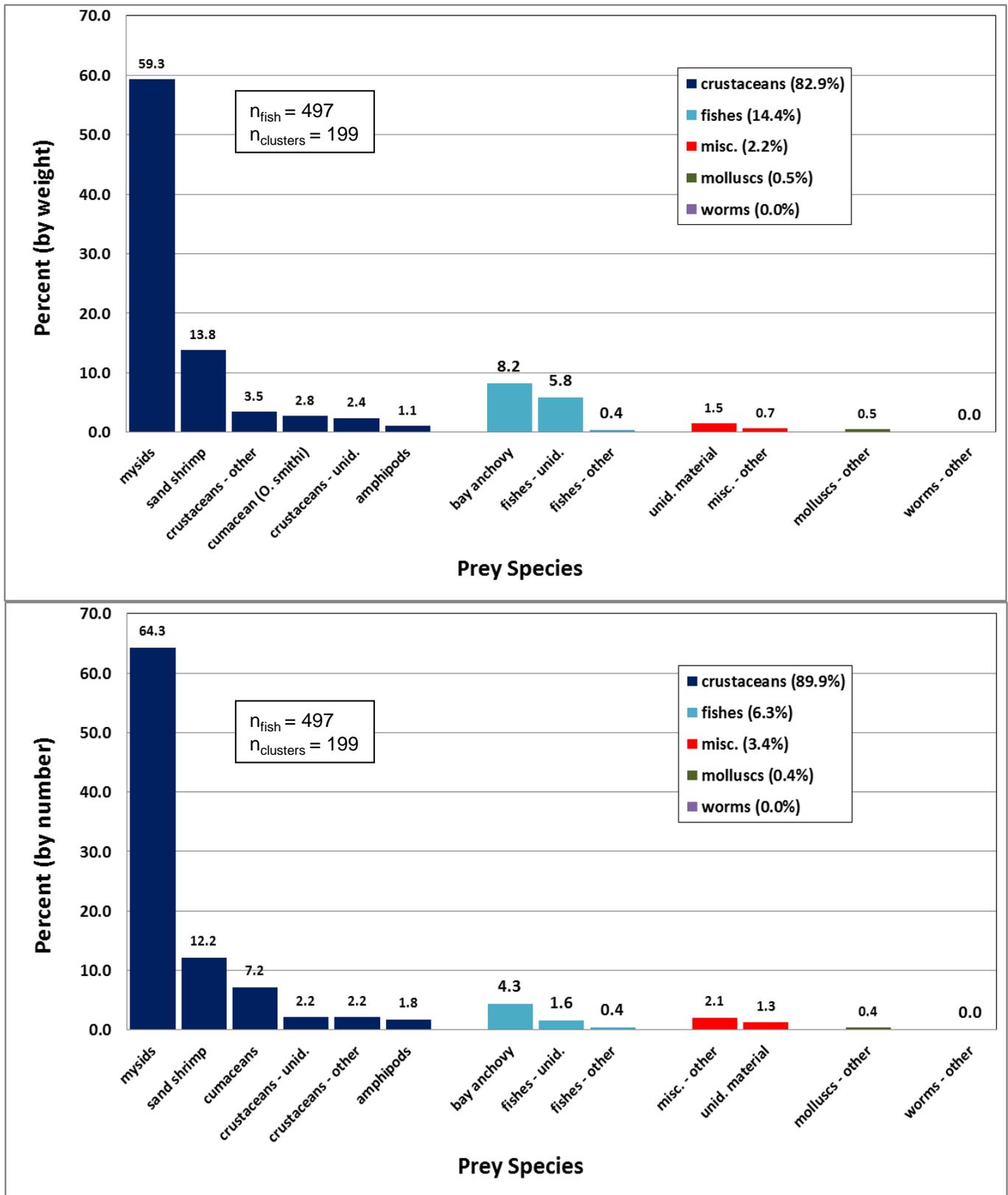
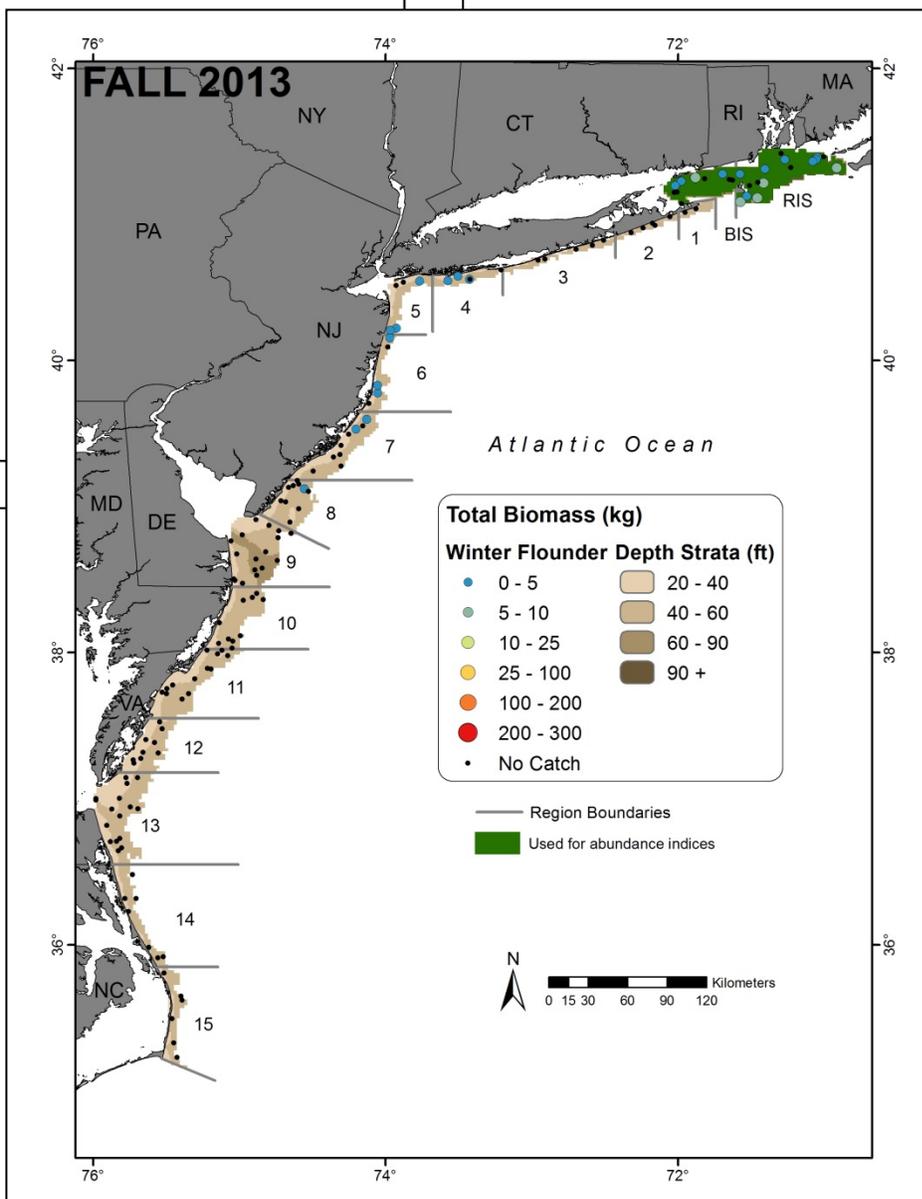
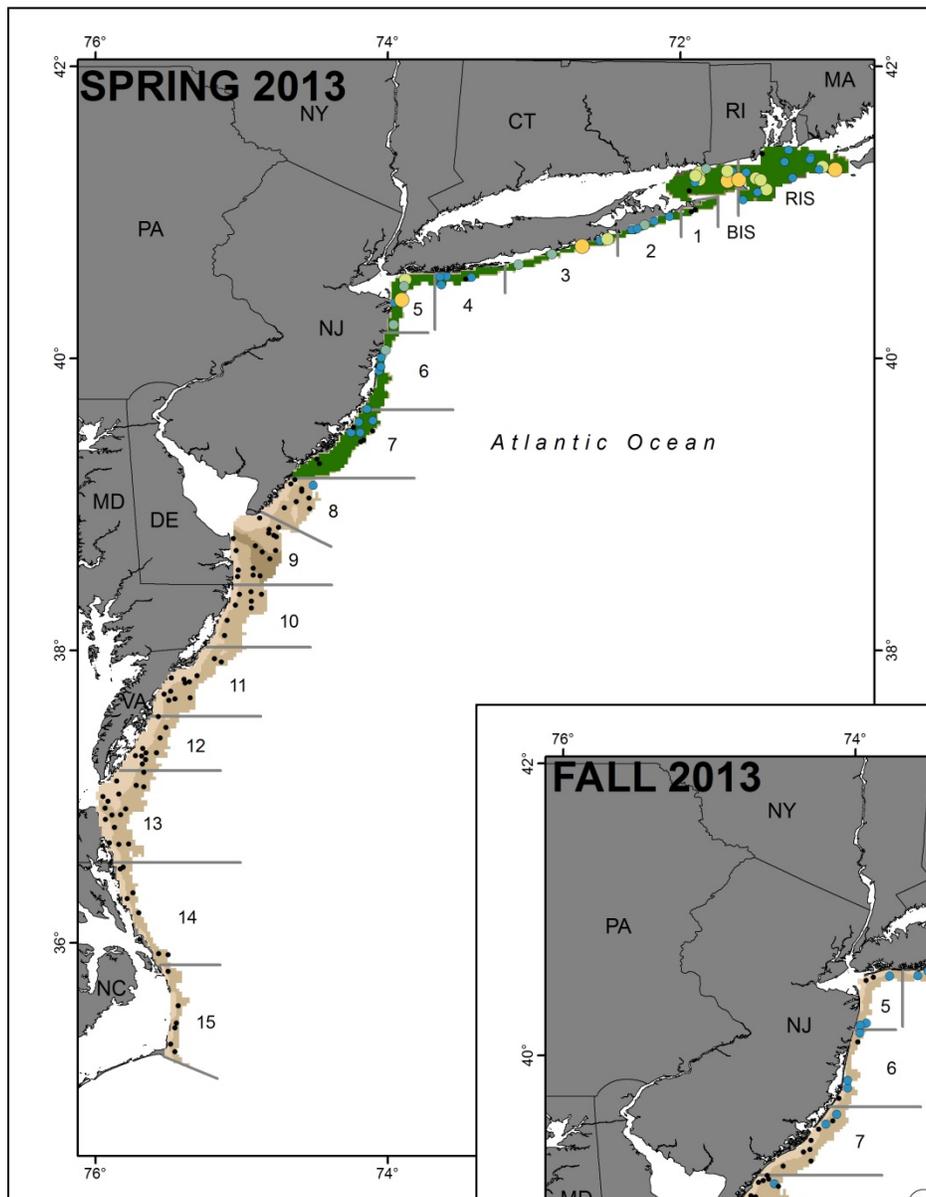
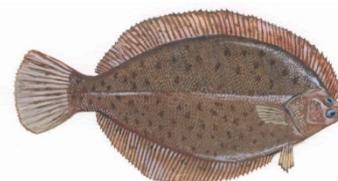


Figure 223. Windowpane Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Winter Flounder Sampling Priority: A

Figure 224. Winter Flounder biomass (kg) collected at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	■
	BIS	90+		
NY	01	40-60	■	■
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40	■	■
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40	■	■
		40-60		
		60-90		
MD	10	20-40	■	■
		40-60		
VA	11	20-40	■	■
		40-60		
		40-60		
NC	12	20-40	■	■
	13	20-40		
	13	40-60		
NC	14	20-40	■	■
		40-60		
		20-40		
		40-60		

■ = used for abundance indices
 ■ = not used for abundance indices

Total Biomass (kg)

Winter Flounder Depth Strata (ft)

- 0 - 5
- 5 - 10
- 10 - 25
- 25 - 100
- 100 - 200
- 200 - 300
- No Catch

- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

— Region Boundaries
 ■ Used for abundance indices

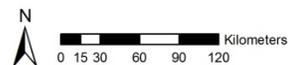


Figure 225. Winter Flounder geometric mean indices of abundance, for all specimens captured (A) and by age-class (B) for spring and fall NEAMAP surveys.



Figure 225. cont.



Figure 226. Winter Flounder length-frequency distributions, by cruise.

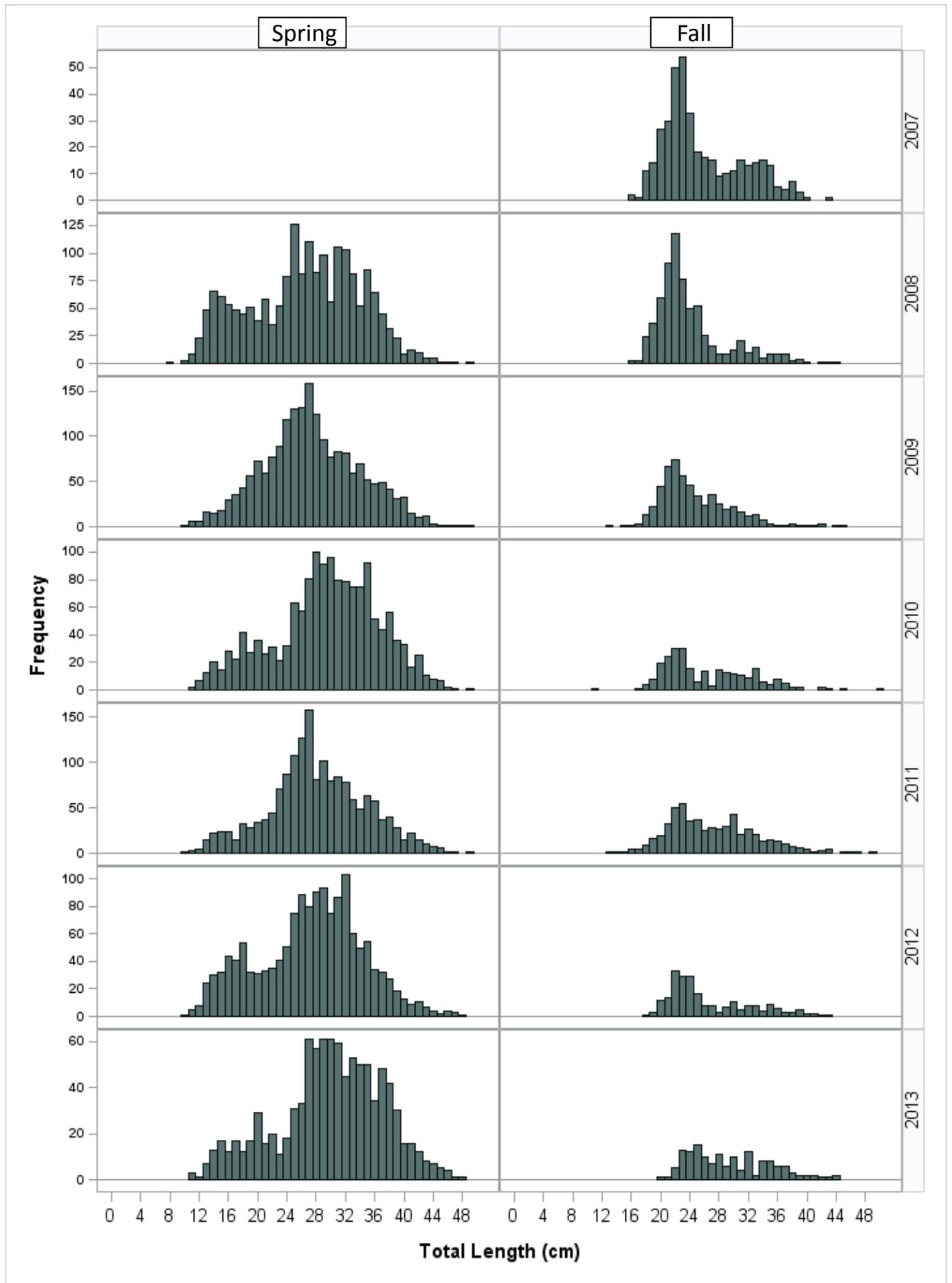


Figure 227. Winter Flounder length-frequency distributions, by cruise and sex.

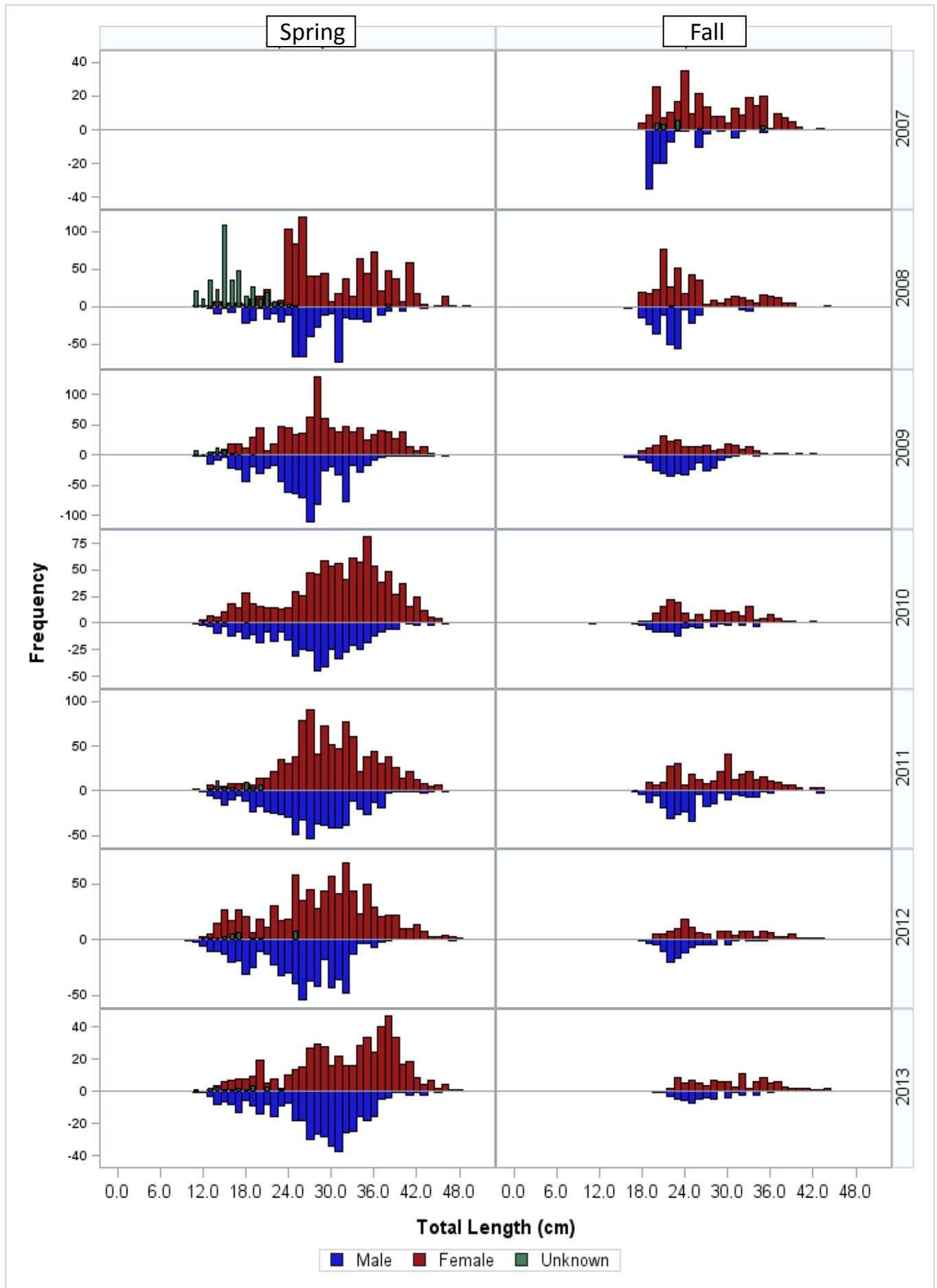


Figure 228. Winter Flounder age-frequency distribution, by cruise. The estimated total number collected at a given age is provided above each corresponding bar. (Values in red were generated by application of age-length keys.)

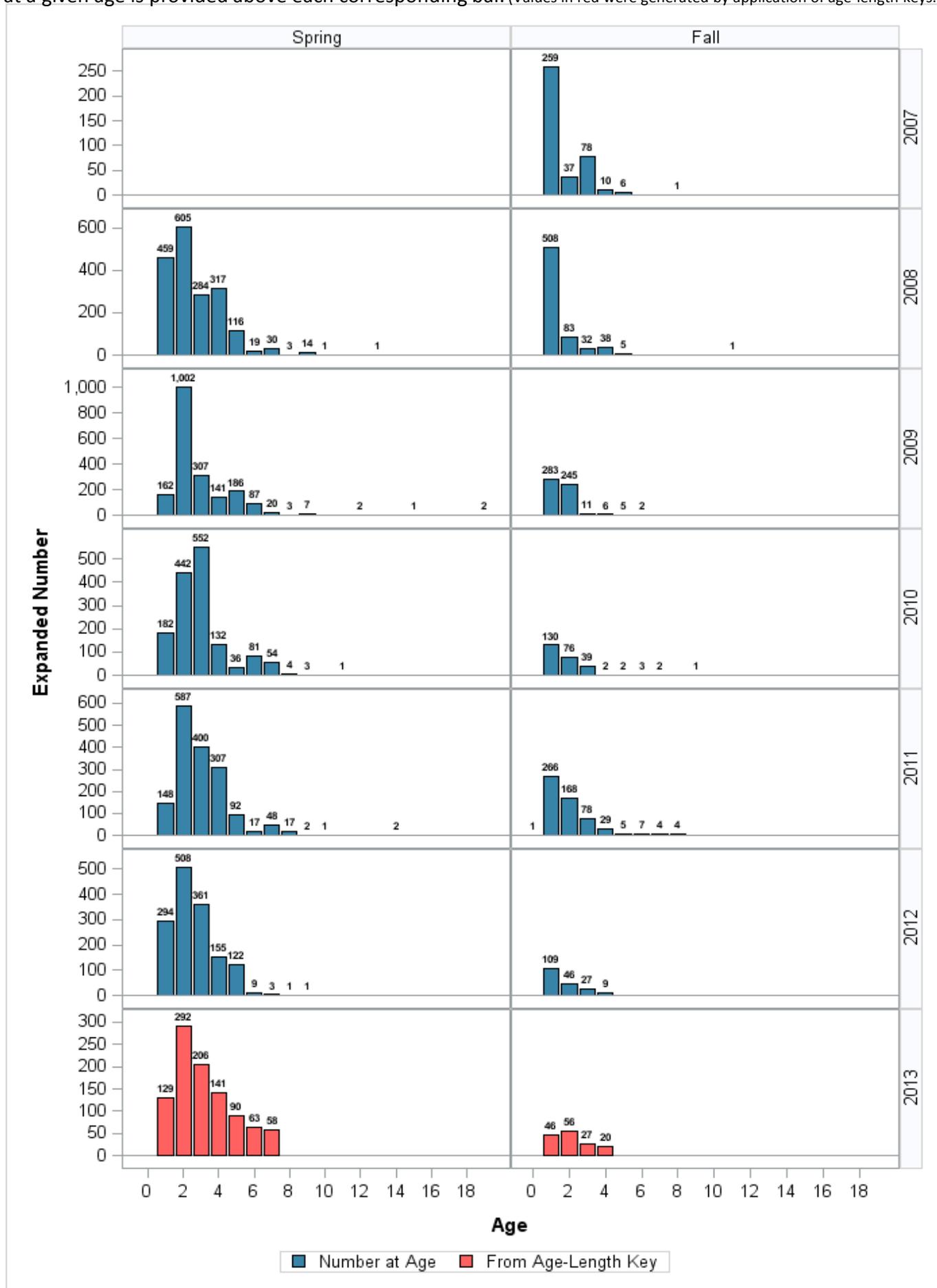


Figure 229. Winter Flounder catch-at-age standardized to 3,000 trawl minutes, by cruise. (Values in red were generated by application of age-length keys.)

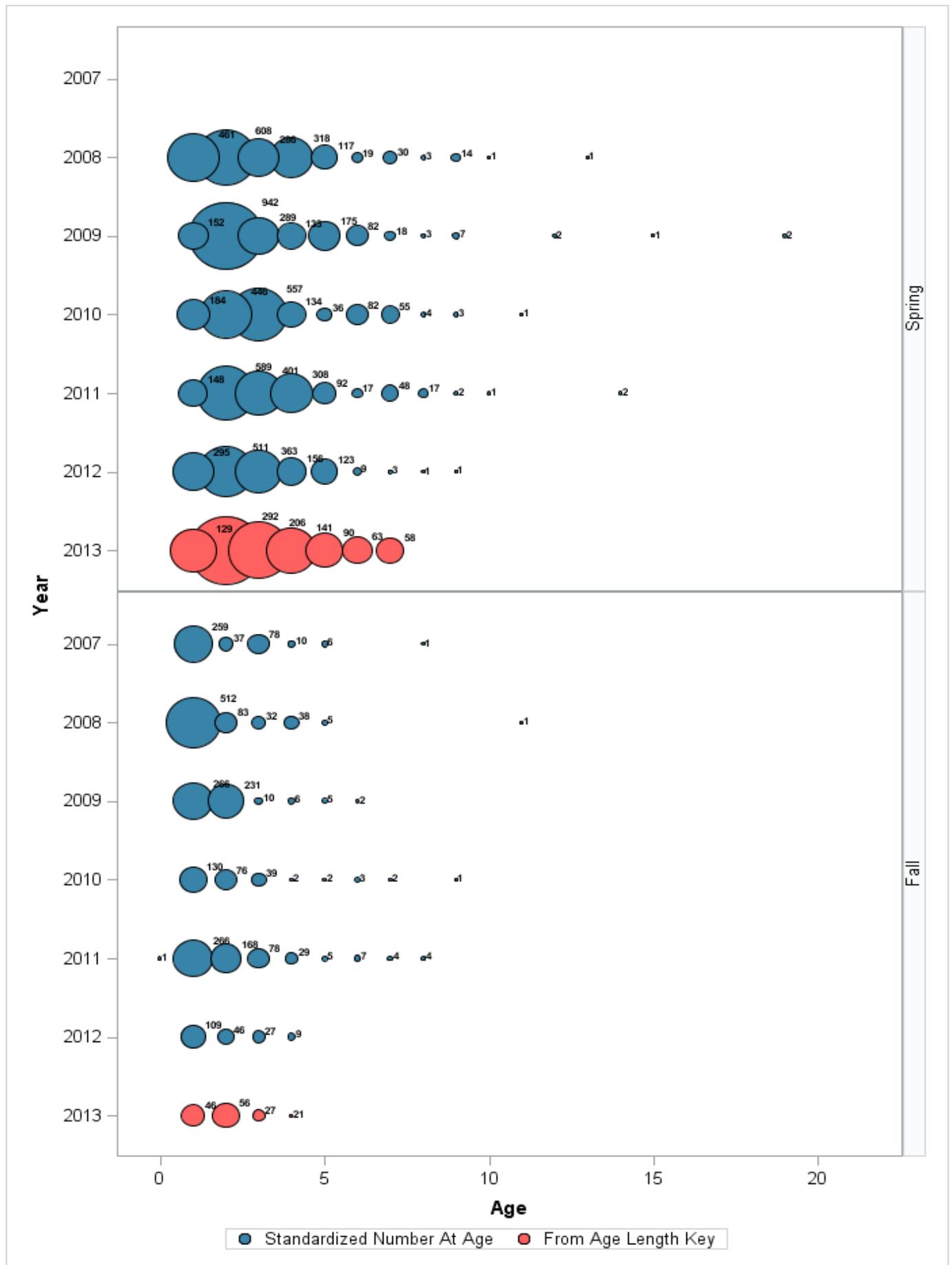


Figure 230. Winter Flounder sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

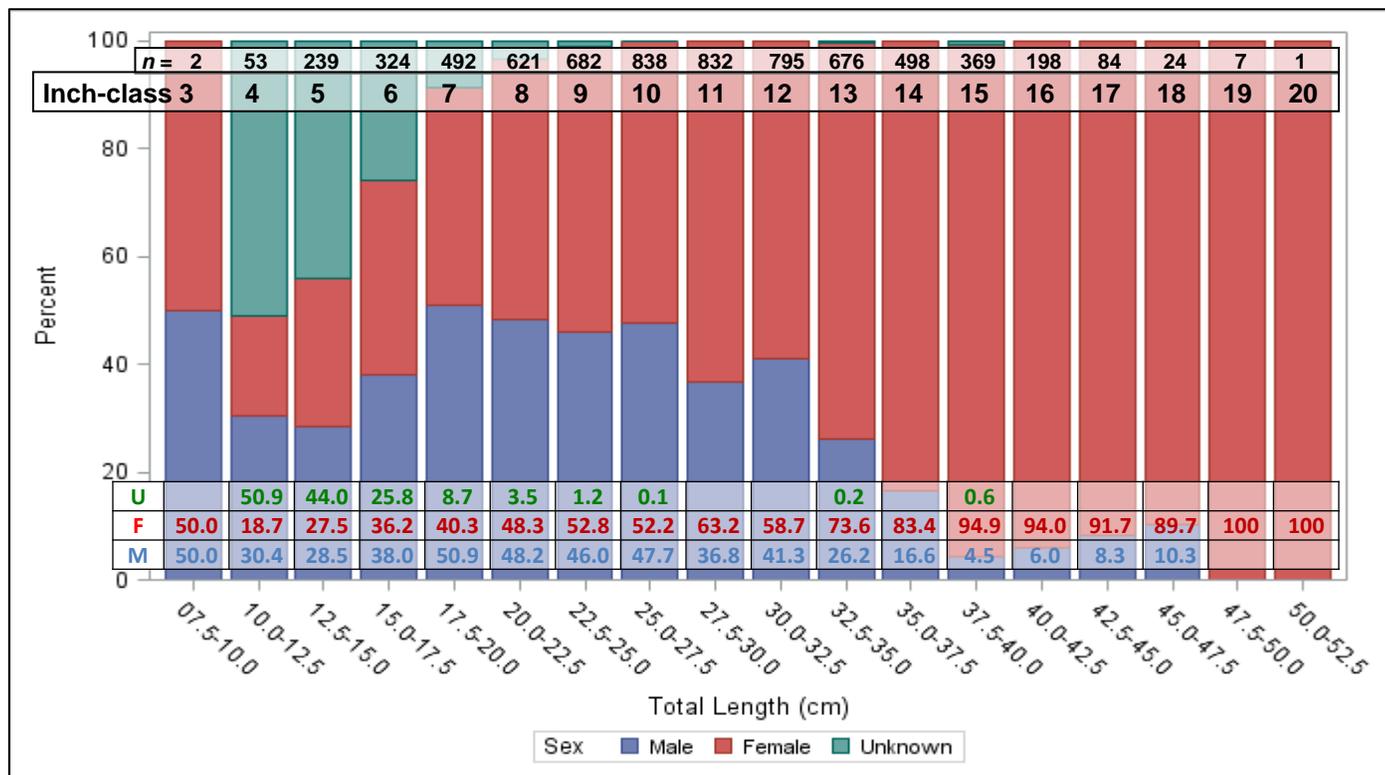


Figure 231. Winter Flounder maturity at length, by sex for all cruises pooled, 2007-2013.

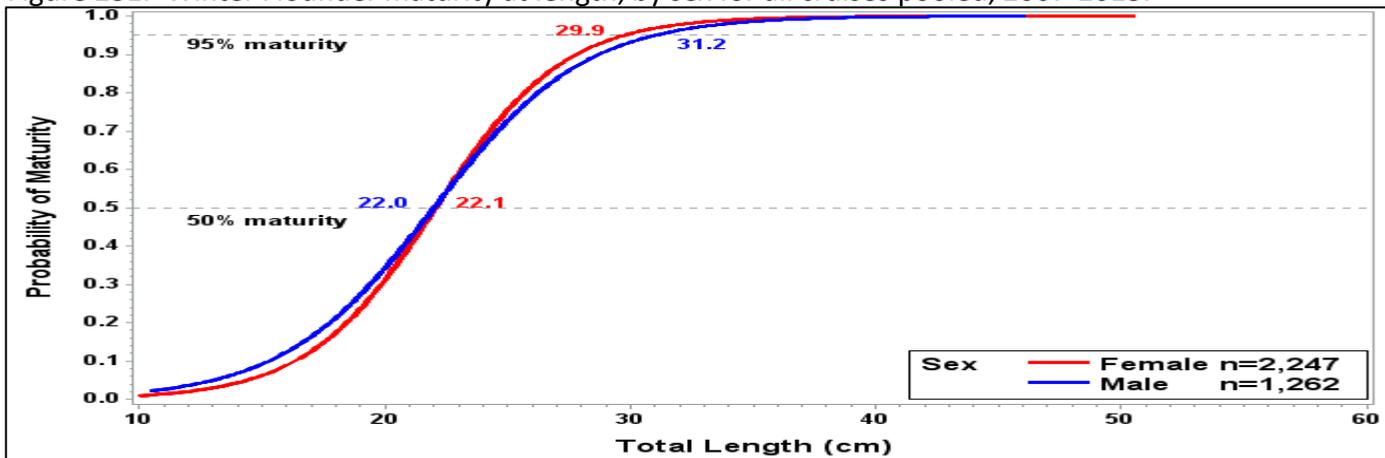


Figure 232. Winter Flounder maturity at age, by sex for all cruises pooled, 2007-2013.

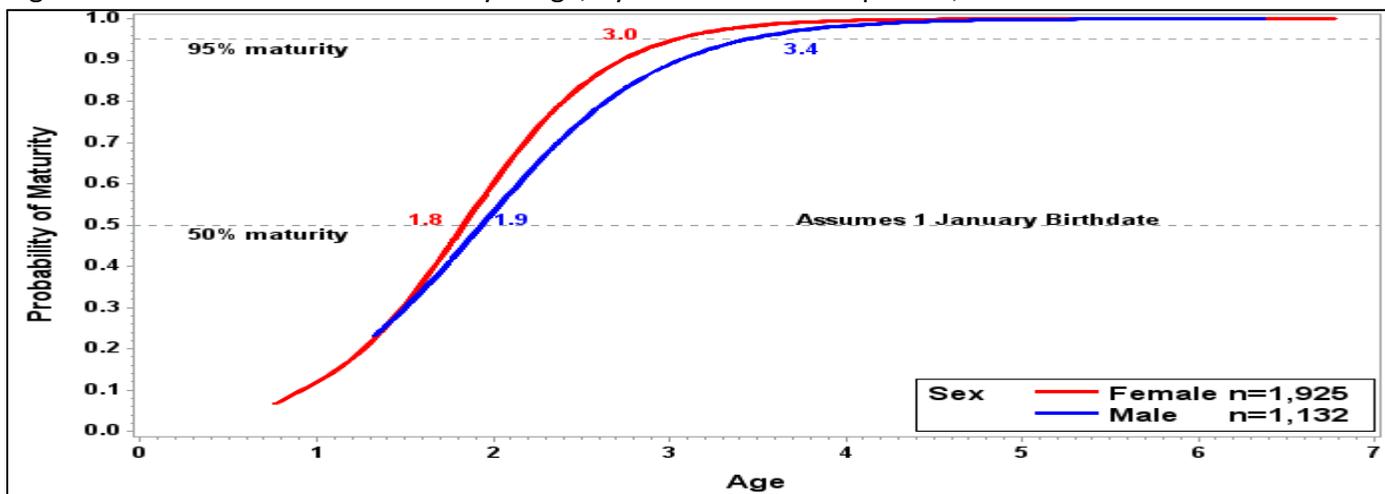
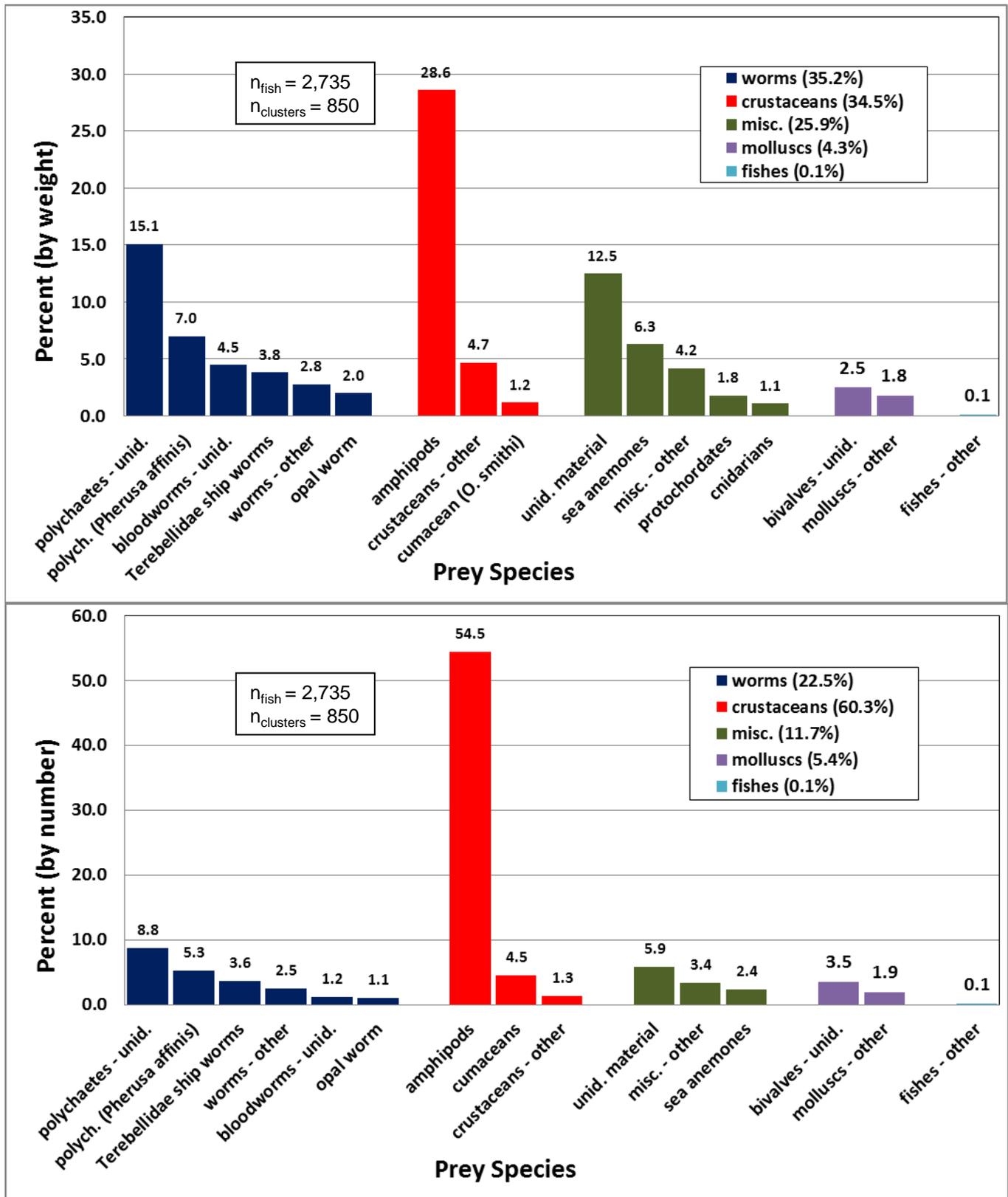


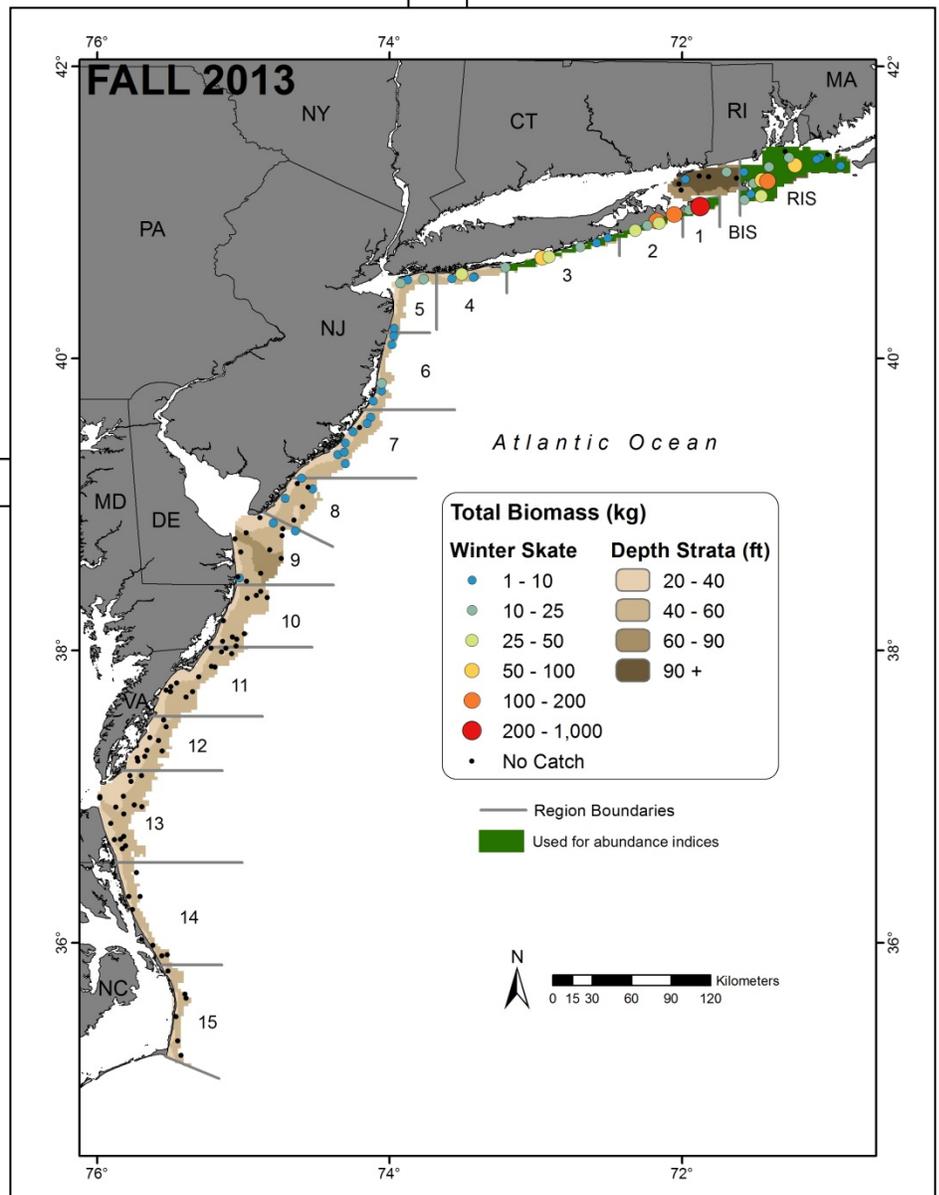
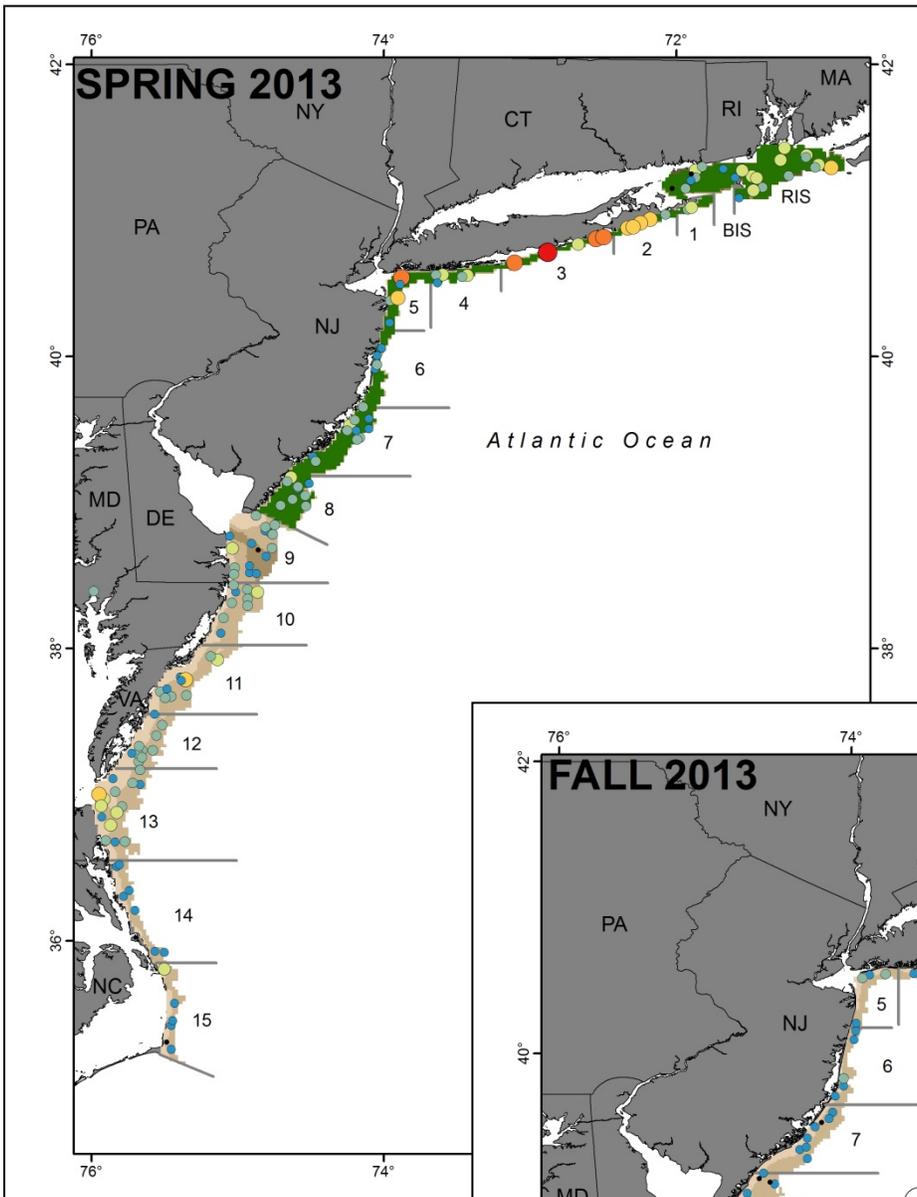
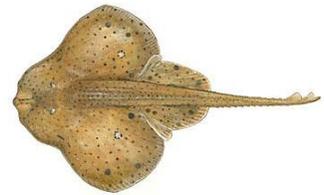
Figure 233. Winter Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Winter Skate

Sampling Priority: A

Figure 234. Winter Skate biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90	■	■
	BIS	90+		
NY	O1	40-60	■	■
	O2	20-40		
	O3	40-60		
	O4	20-40		
	O5	40-60		
NJ	O6	20-40	■	■
	O7	40-60		
	O8	20-40		
	O8	40-60		
DE	O9	20-40	■	■
		40-60		
		60-90		
MD	10	20-40	■	■
	40-60			
VA	11	20-40	■	■
		40-60		
		20-40		
NC	12	40-60	■	■
	13	20-40		
	15	40-60		
		20-40	■	■
		40-60		

■ = used for abundance indices
 ■ = not used for abundance indices

Total Biomass (kg)

Winter Skate	Depth Strata (ft)
● 1 - 10	■ 20 - 40
● 10 - 25	■ 40 - 60
● 25 - 50	■ 60 - 90
● 50 - 100	■ 90 +
● 100 - 200	
● 200 - 1,000	
● No Catch	

— Region Boundaries
 ■ Used for abundance indices

N
 0 15 30 60 90 120 Kilometers

Table 78. Winter Skate sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1,716	3,174.2	1,217	320	0	302	300
	2009	3,595	6,850.0	1,778	374	0	346	338
	2010	1,547	3,985.6	851	287	0	276	268
	2011	2,271	4,413.2	1,540	275	0	222	221
	2012	3,775	5,265.4	1,914	295	0	243	227
	2013	3,029	3,419.3	2,915	416	0	348	336
Fall	2007	951	925.3	735	171	0	160	159
	2008	624	929.7	404	120	0	115	115
	2009	1,787	4,040.3	623	123	0	108	108
	2010	1,177	2,169.6	806	122	0	104	102
	2011	1,301	1,451.7	1,018	129	0	97	90
	2012	1,259	1,146.8	835	121	0	84	82
	2013	1,535	1,644.3	981	169	0	134	0

Table 79. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

Spring Survey							Fall Survey										
Age	Year	n	Numerical Index			Biomass Index			Age	Year	n	Numerical Index			Biomass Index		
			LCI	Index	UCI	LCI	Index	UCI				LCI	Index	UCI	LCI	Index	UCI
All	2007								All	2007	29	7.71	12.63	20.33	8.60	13.08	19.64
	2008	73	7.97	9.88	12.19	10.32	12.99	16.28		2008	28	6.42	9.53	13.94	8.92	12.57	17.56
	2009	79	8.26	10.35	12.89	12.26	15.95	20.66		2009	31	5.21	7.79	11.43	7.95	12.30	18.77
	2010	72	4.25	5.37	6.74	9.13	11.59	14.64		2010	28	6.35	12.11	22.38	7.45	14.72	28.27
	2011	72	5.67	7.41	9.61	10.63	13.76	17.74		2011	28	9.73	17.80	31.91	9.99	17.63	30.59
	2012	72	9.82	12.28	15.29	12.75	16.30	20.78		2012	28	8.52	14.42	23.99	8.26	13.99	23.27
	2013	72	8.77	11.57	15.18	9.64	12.53	16.20		2013	28	7.73	15.51	30.24	6.23	12.76	25.18
	2014									2014							
	2015									2015							
	2016									2016							

Figure 235. Winter Skate geometric mean indices of abundance, by number and biomass, for spring and fall NEAMAP surveys, for all specimens captured.

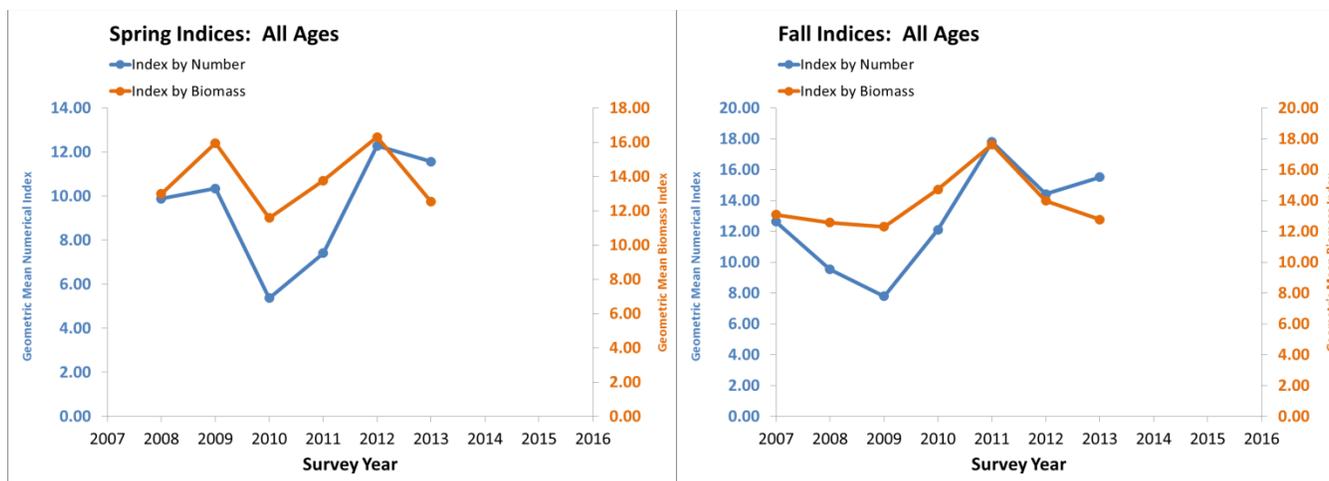


Figure 236. Winter Skate length-frequency distributions, by cruise.

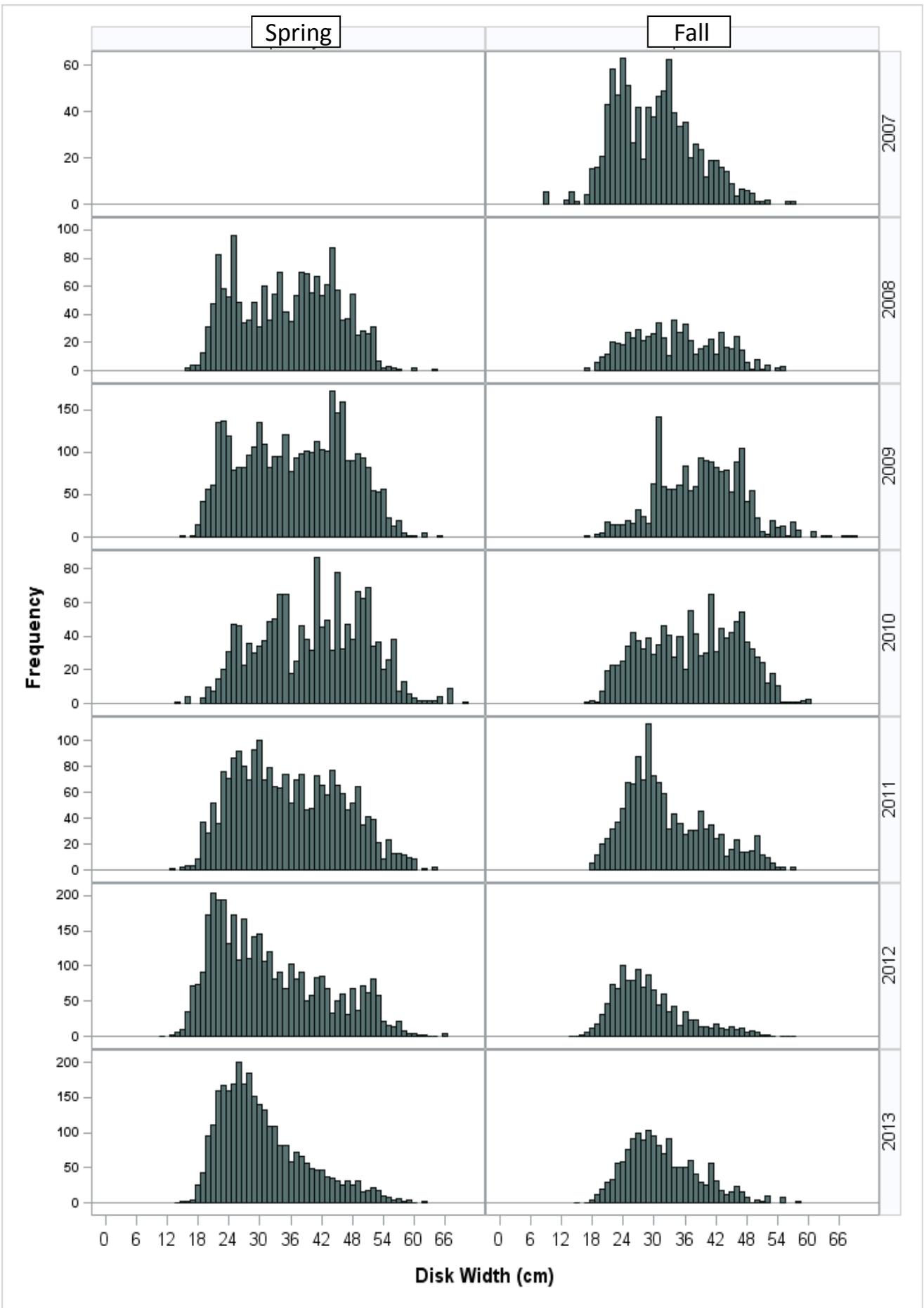


Figure 237. Winter Skate length-frequency distributions, by cruise and sex.

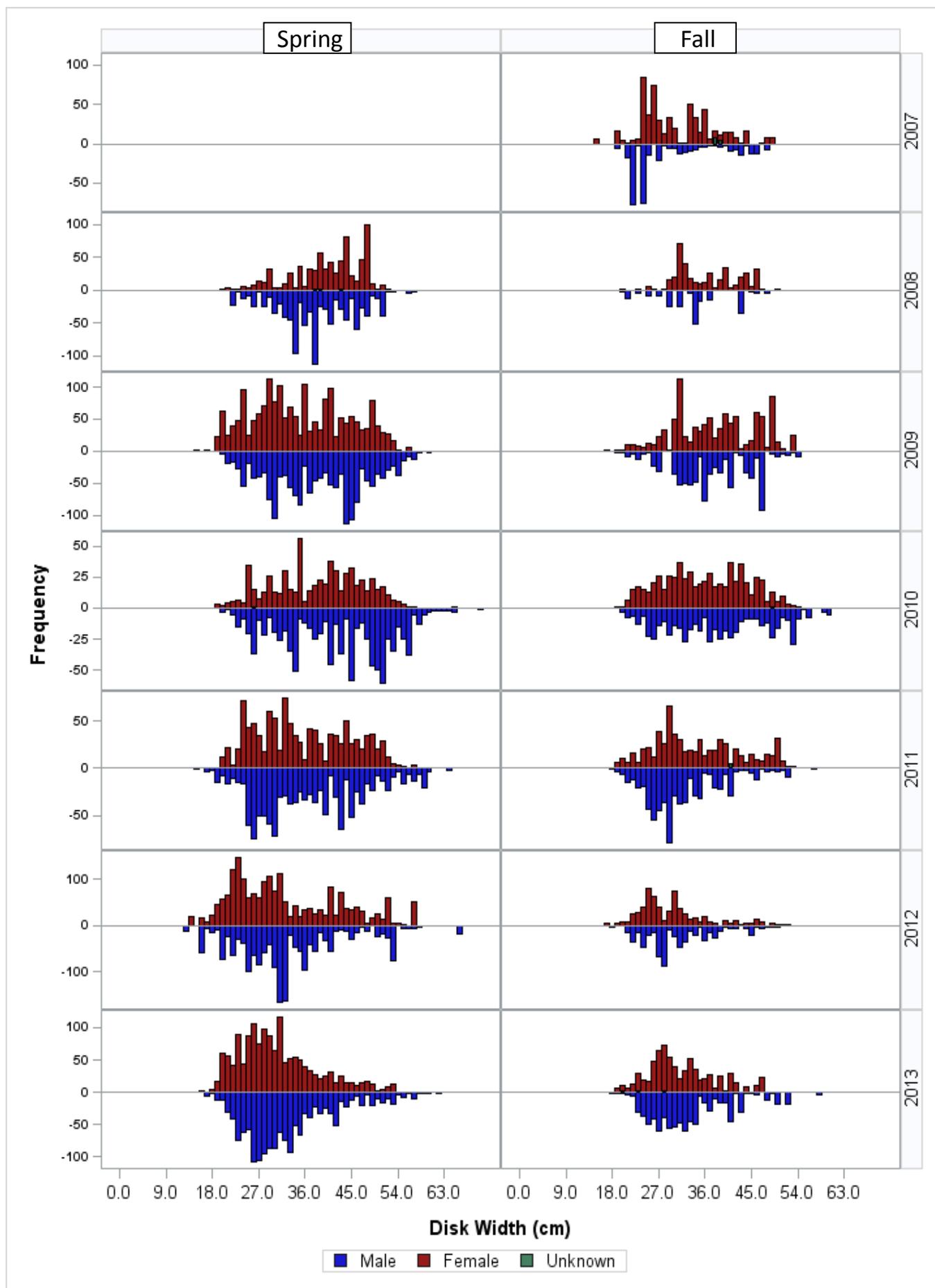


Figure 238. Winter Skate sex ratio, by length group, for all cruises pooled, 2007-2013.

(The percentages for each category are given near the bottom of each bar. The number sampled for sex determination and the approximate length categories expressed in inches are provided near the top of each bar.)

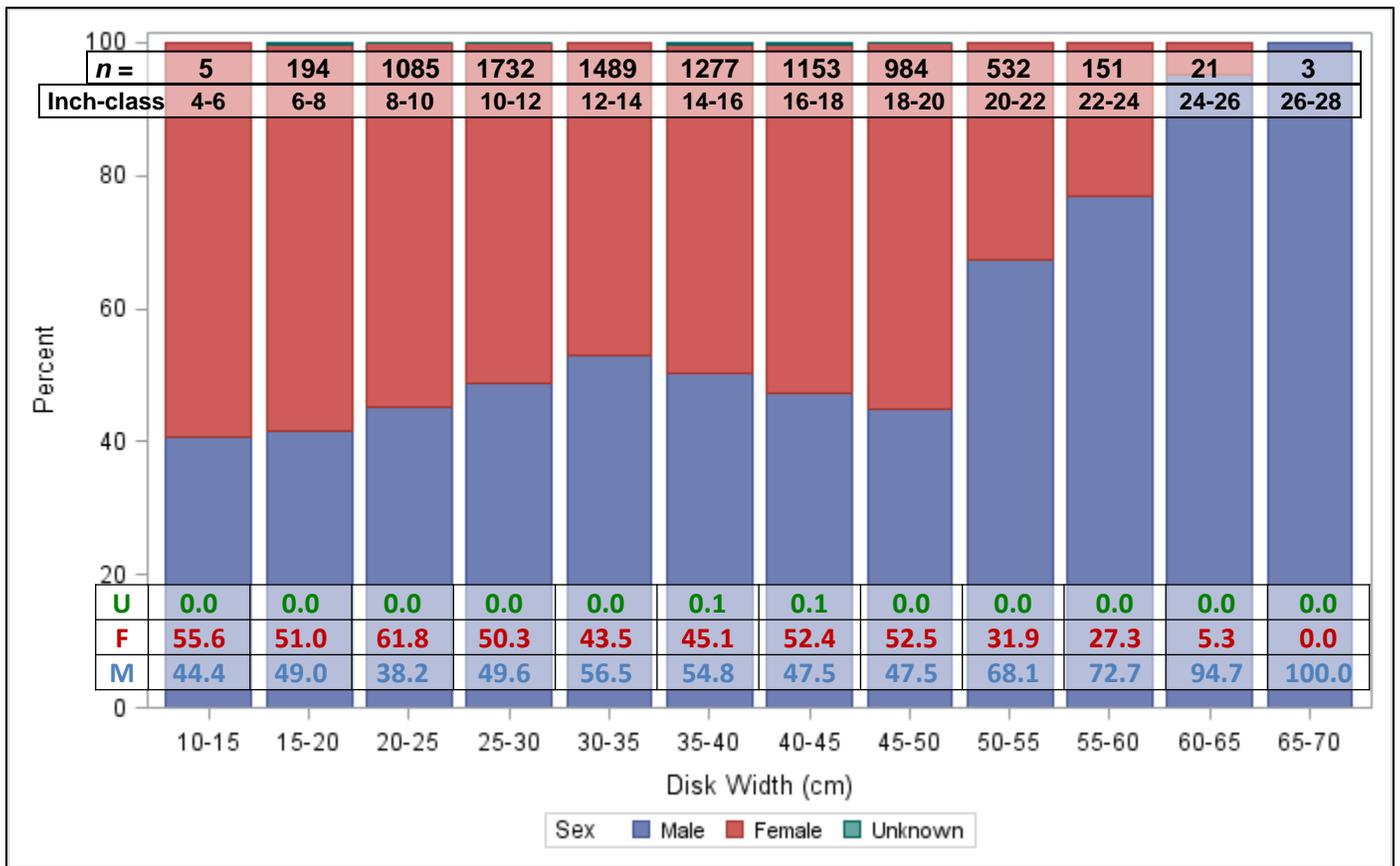


Figure 239. Winter Skate maturity at length, by sex for all cruises pooled, 2007-2013.

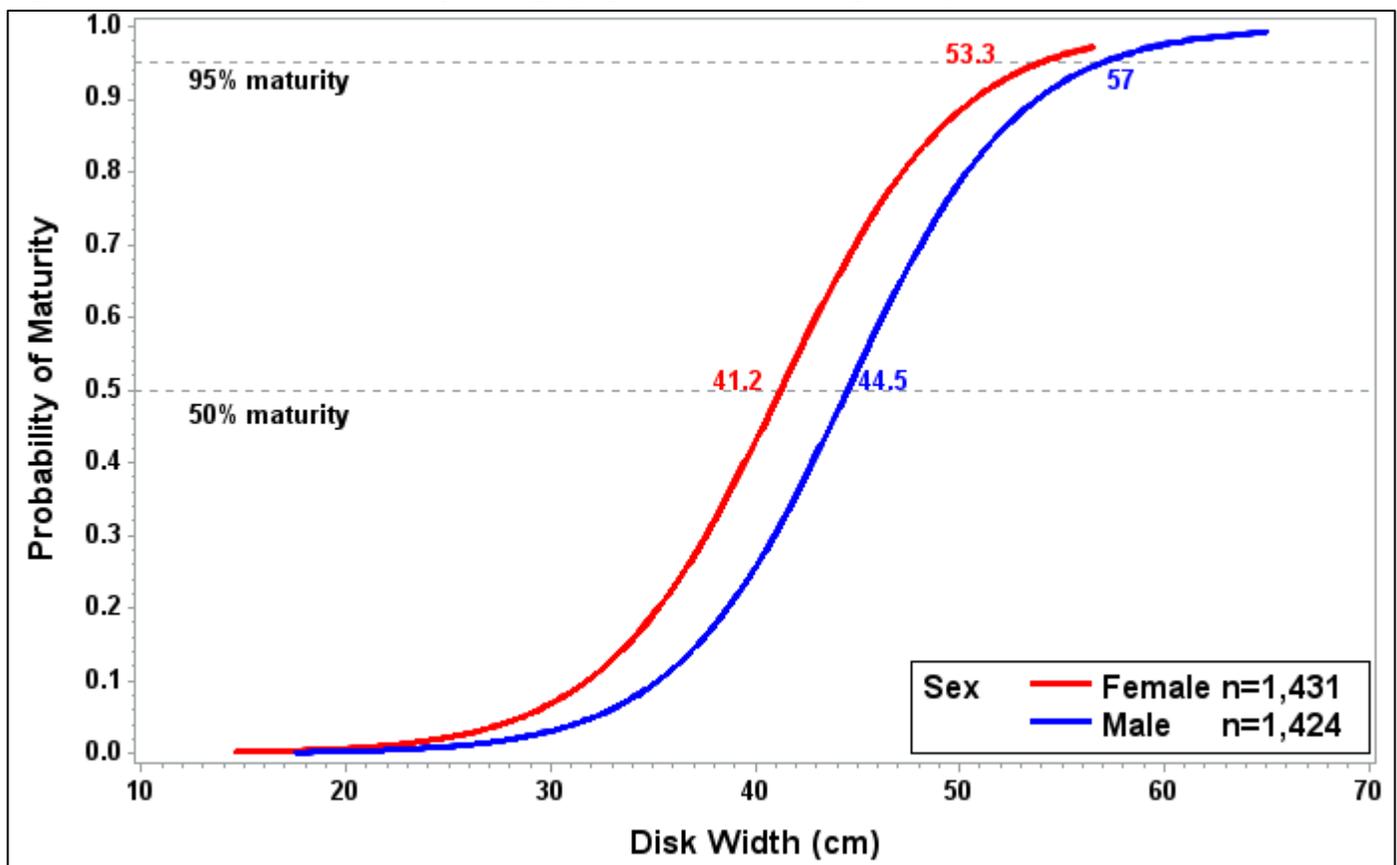
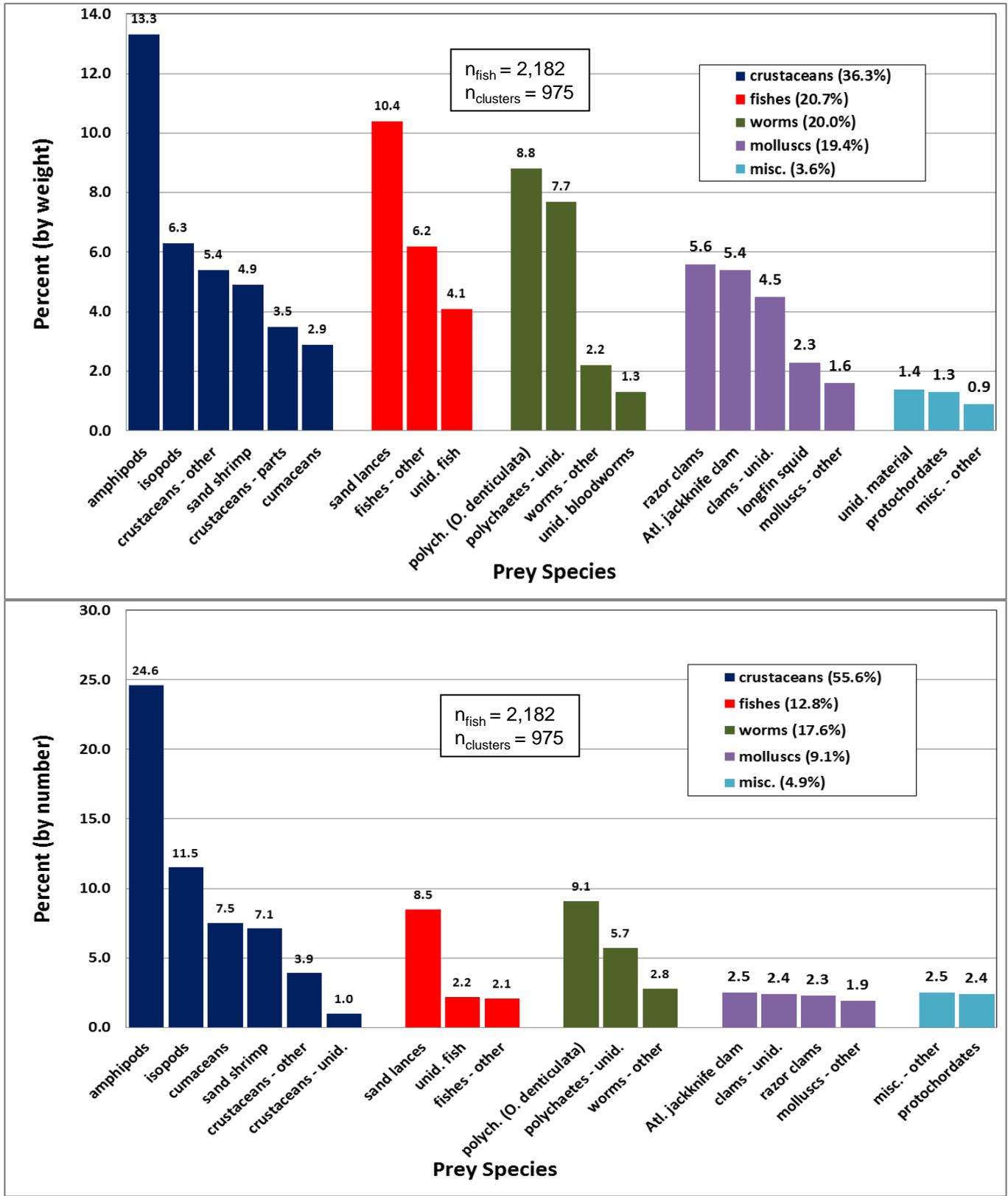


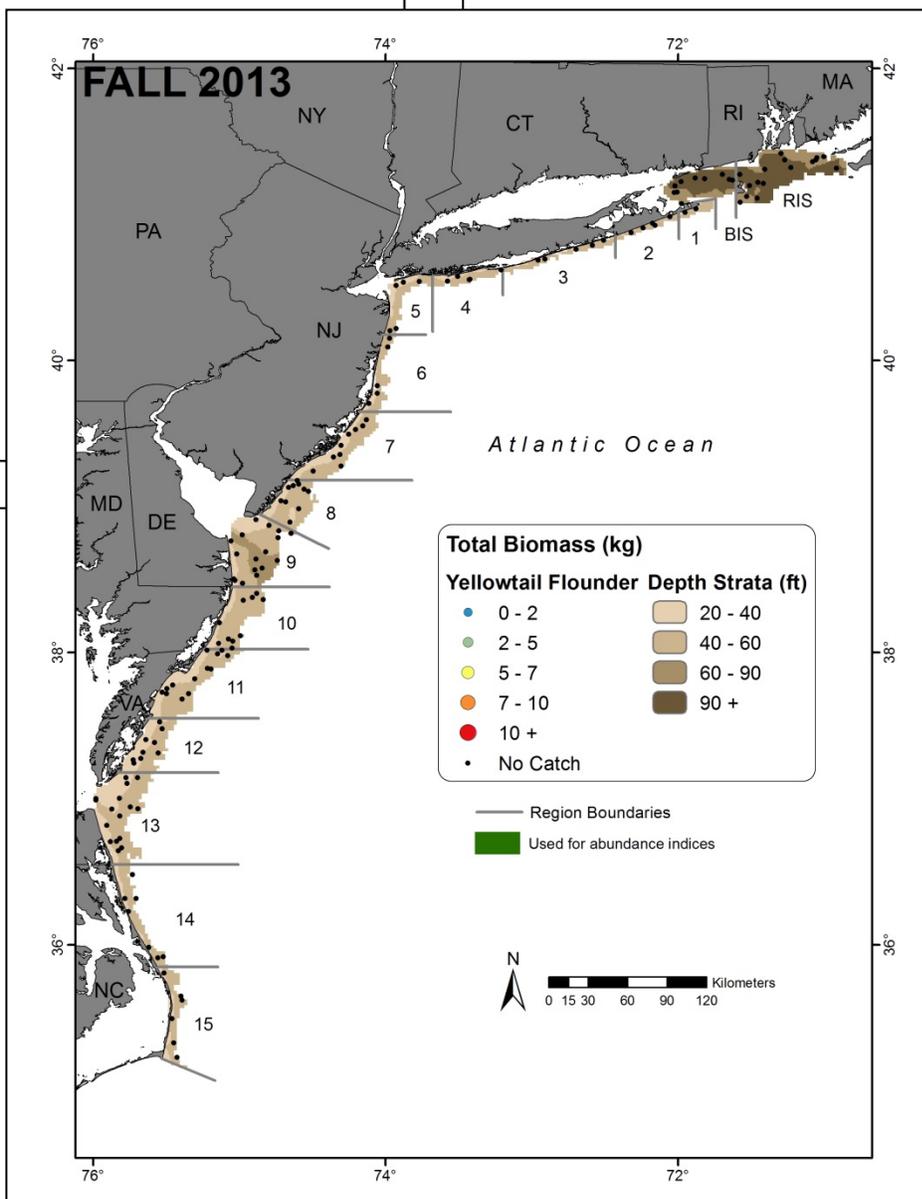
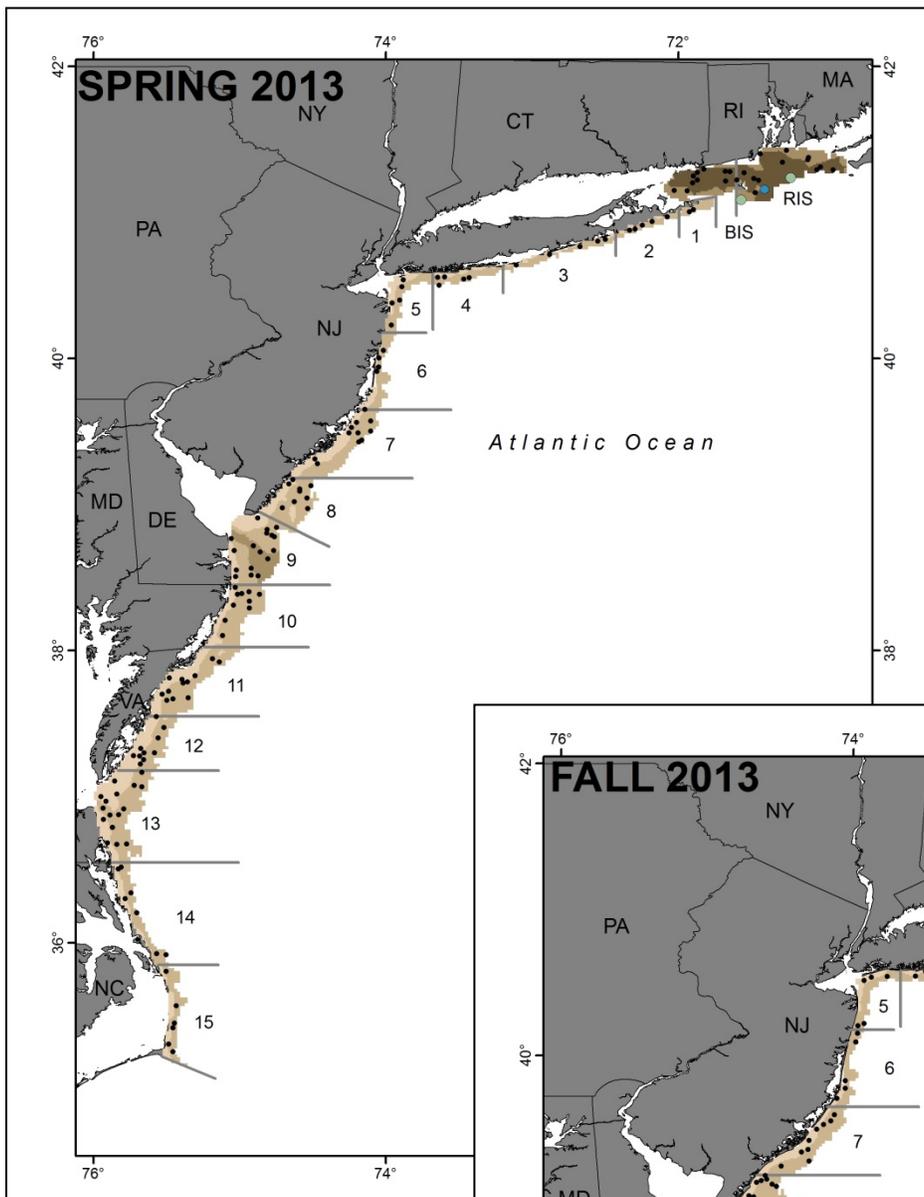
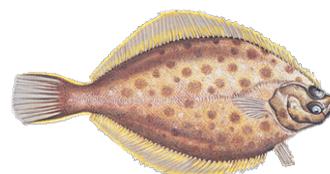
Figure 240. Winter Skate diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)



Yellowtail Flounder

Sampling Priority: A

Figure 241. Yellowtail Flounder biomass (kg) at each sampling site for 2013 NEAMAP cruises and strata used for calculation of abundance indices.



State (Nominal)	Region	Depth Stratum	Spring Index	Fall Index
RI	RIS	60-90		
	BIS	90+		
NY	01	40-60		
	02	20-40		
	03	40-60		
	04	20-40		
	05	40-60		
NJ	06	20-40		
	07	40-60		
	08	20-40		
	08	40-60		
DE	09	20-40		
	09	40-60		
	09	60-90		
MD	10	20-40		
VA	11	20-40		
	11	40-60		
	11	40-60		
	11	40-60		
NC	14	20-40		
	14	40-60		
	14	20-40		

= used for abundance indices
 = not used for abundance indices

Total Biomass (kg)

Yellowtail Flounder Depth Strata (ft)

- 0 - 2
- 2 - 5
- 5 - 7
- 7 - 10
- 10 +
- No Catch

- 20 - 40
- 40 - 60
- 60 - 90
- 90 +

Region Boundaries
 Used for abundance indices

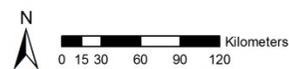


Table 80. Yellowtail Flounder sampling rates and preserved specimen analysis status for each NEAMAP cruise.

Season	Year	Number Caught	Biomass Caught (kg)	Number Measured	Age Specimens	Ages Read	Stomach Specimens	Stomachs Analyzed
Spring	2008	1	0.3	1	1	0	0	0
	2009	52	21.3	52	19	0	19	19
	2010	36	19.3	36	21	0	20	20
	2011	2	0.7	2	1	0	1	1
	2012	26	9.9	26	21	0	20	20
2013	15	6.6	15	11	0	9	9	
Fall	2007	1	0.1	1	1	0	1	1
	2008	2	0.3	2	2	0	2	2
	2009	1	0.2	1	1	0	1	1
	2010	-	0.0	0	0	0	0	0
	2011	1	0.1	1	1	0	1	1
	2012	-	0.0	0	0	0	0	0
	2013	-	0.0	0	0	0	0	0

Figure 242. Yellowtail Flounder length-frequency distributions, by cruise.

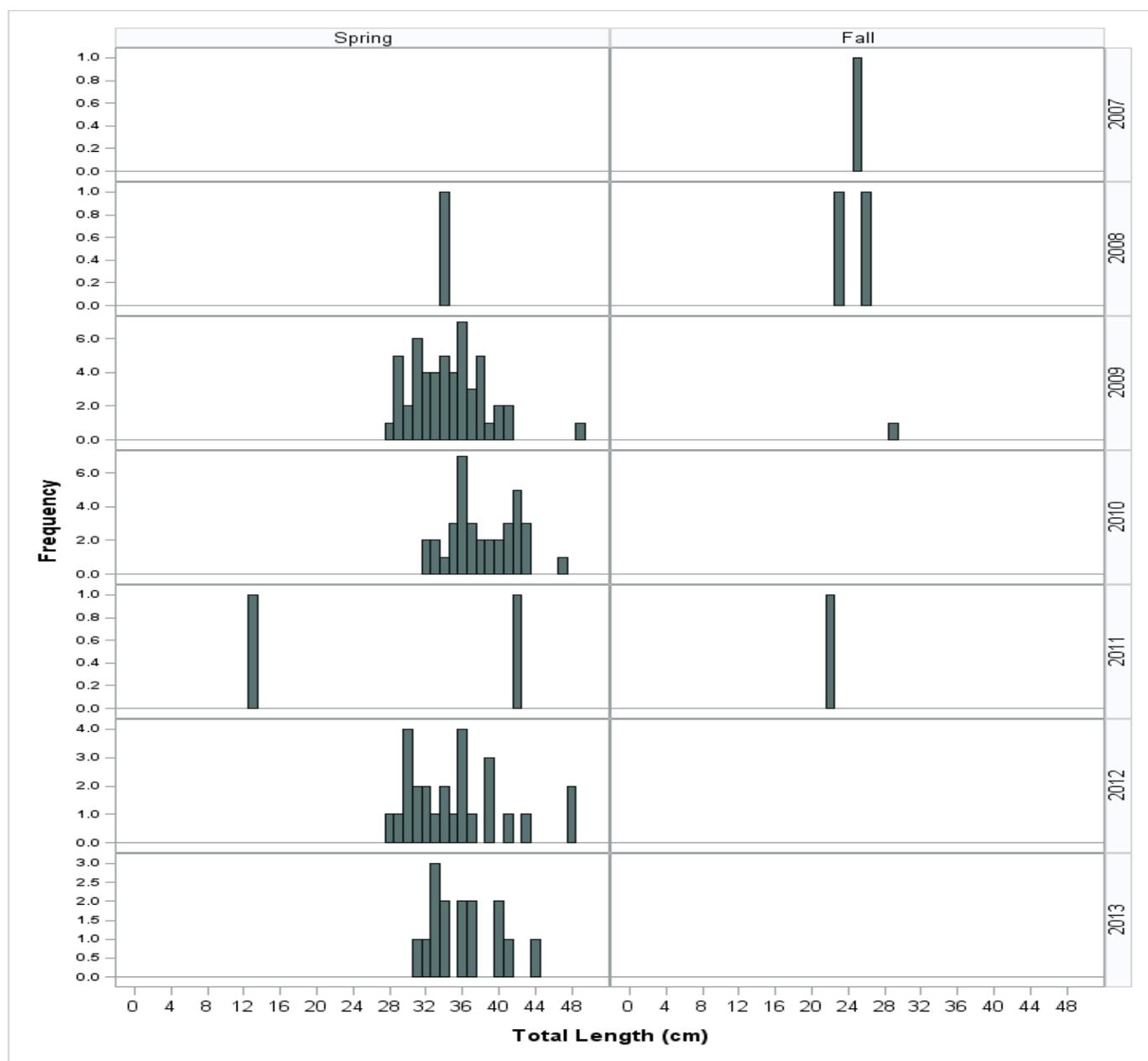


Figure 243. Yellowtail Flounder length-frequency distributions, by cruise and sex.

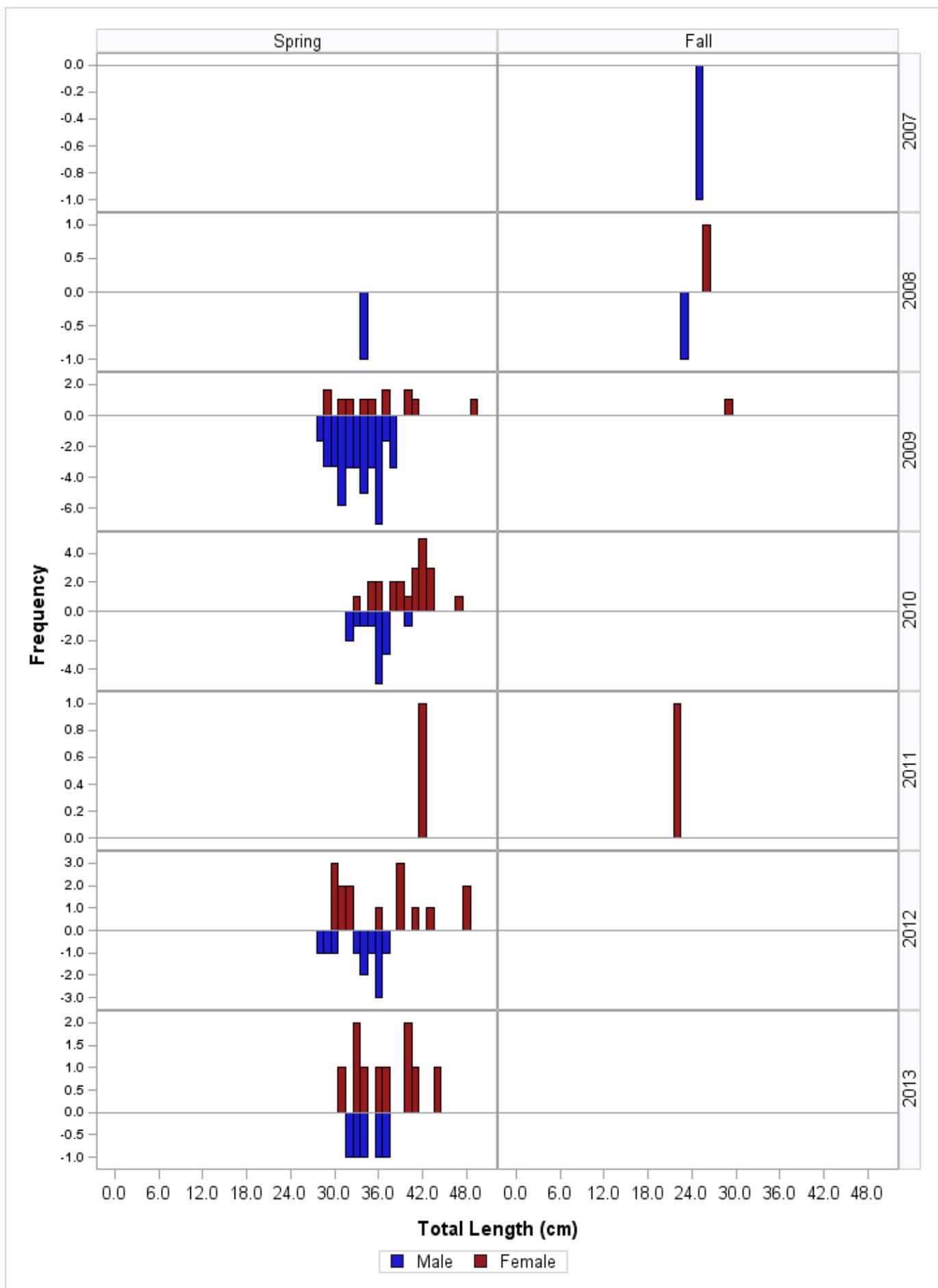


Figure 244. Yellowtail Flounder diet composition, expressed as percent by weight and number collected during NEAMAP cruises in 2007 through 2013. (The number of fish sampled for diet is given by n_{fish} , while $n_{clusters}$ indicates the number of clusters of this species sampled.)

